Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Bact. phas.
p. 89
F. Hedges
notes made

AGRICULTURAL STATION
RECEIVED
☆ MAR 27 1941 ☆
LIBRARY
VILLE, MARYLAND

THE PLANT DISEASE BULLETIN

Issued By

THE PLANT DISEASE SURVEY

Supplement 26

Diseases of Field and Vegetable Crops In the United States in 1922

June 15, 1923

BUREAU OF PLANT INDUSTRY
UNITED STATES DEPARTMENT OF AGRICULTURE

624889
Agri.
14-23
USDA
LIB

526214

DISEASES OF FIELD AND VEGETABLE CROPS IN THE UNITED STATES IN 1922

Prepared by Charles Chupp
Collaborator with the Plant Disease Survey, and Assistant Professor,
Department of Plant Pathology, New York State College of Agriculture.

CONTENTS

- Introduction ... 2
- Potato - Seed certification ... 6
  - Diseases ... 8
    - Late blight ... 8
    - Early blight ... 11
    - Fusarium wilt ... 14
    - Wart ... 17
    - Rhizoctonia ... 19
    - Scab ... 24
    - Blackleg ... 28
    - Mosaic ... 31
    - Leafroll ... 35
    - Tipburn and hopperburn ... 37
    - Other degeneration diseases ... 40
    - Yellow dwarf ... 43
    - Poor stands, etc. ... 45
    - Use of sulfur on cut seed ... 45
    - Miscellaneous parasitic diseases ... 46
    - Miscellaneous non-parasitic diseases ... 49
    - General references on potato diseases ... 52
- Diseases of tomato ... 53
  - Leaf spot ... 53
  - Fusarium wilt ... 55
  - Western yellow blight ... 59
  - Early blight and nailhead spot ... 59
  - Mosaic ... 61
  - Blossom-end rot ... 62
  - Leaf mold ... 64
  - Bacterial blight ... 64
  - Root knot ... 64

  - Miscellaneous

    - Affecting stem ... 65
    - Affecting fruit or blossom ... 66
  - New diseases ... 67
  - General references ... 67
- Sweet potato - Certification ... 69
  - Diseases ... 80
- Diseases of bean ... 89
- Diseases of Lima bean ... 96
- Diseases of onion ... 97
- Diseases of crucifers ... 100
  - Cabbage ... 100
  - Brussels sprouts ... 109
  - Cauliflower ... 109
  - Chinese cabbage ... 110
  - Cress ... 110
  - Horse radish ... 110
  - Kale ... 110
  - Mustard ... 110
  - Radish ... 111
  - Rutabaga ... 111
  - Turnip ... 111
- Diseases of cucurbits ... 112
  - Cantaloupe ... 112
  - Citron ... 114
  - Cucumber ... 114
  - Pumpkin ... 119
  - Squash ... 119
  - Watermelon ... 120
- Diseases of cotton ... 123
- Diseases of sugar cane ... 129
- Diseases of sugar beet ... 132
- Diseases of tobacco ... 135
- Diseases of miscellaneous vegetable crops ... 143
  - Artichoke ... 143
  - Asparagus ... 143
  - Beet (garden) ... 144
  - Carrot ... 145
  - Celery ... 146
  - Chicory ... 149
  - Eggplant ... 149
  - Endive ... 150
  - Escarole ... 151
  - Ginseng ... 151
  - Lettuce ... 151
  - Mangel ... 155
  - Okra ... 155
  - Parsley ... 155
  - Pea ... 156
  - Peanut ... 159
  - Pepper ... 160
  - Rhubarb ... 160
  - Salsify ... 161
  - Spinach ... 161
  - Swiss chard ... 163

INTRODUCTION

The general plan of the preceding years has been followed in summarizing the data on the vegetable diseases of 1922. An attempt has been made to include in the references the more accessible articles, and even brief abstracts of the points which were of most interest. It is hoped that this may be of benefit to some of the men who deal with vegetable pathology, and who may not have all the references readily available.

Notes on Geographic Distribution

In looking over the Plant Disease Survey reports one is impressed, in a number of cases, with the apparent lack of information regarding the cause of a certain trouble in a given state. For instance, on rhubarb Ascochyta rhei, Cercospora, Phyllosticta, Alternaria and possibly others have been reported. Are all of these in the same states, or are they distributed among the different states? Again various bacteria such as viridilividum, vitians, marginale and rhizoctonia, as well as a number of unidentified species, have been reported on lettuce. What is the geographic range of each? Are they all found in the same territory, or have they definite limited areas? These points, as well as others of a similar nature, should be made clear by the collaborators the coming season.

There is a root rot in nearly every locality where peas are grown. F. R. Jones has done much to clarify the situation regarding the cause of these root rots. Fusarium, Pythium and Rhizoctonia are concerned. Are all of these fungi responsible? If so, are they intermixed or have they definite boundaries? Is the leaf spot on parsley which the collaborators report, caused by Cercospora or by Cercosporella, or both? The bean root rots evidently are everywhere, but few of the reporters are sure of the organism connected with the disease. Is it caused by Fusarium, Rhizoctonia, Thielavia, or others, and what is the geographical distribution of each? Septoria consimilis and Septoria lactucae have been reported on lettuce. Which is the more common? What is their distribution? With the western yellow blight of tomato, Corticium, Fusarium, etc. are given as the cause. These are examples of some of the numerous problems that the Plant Disease Survey organization can assist in solving.

Table 1. Some of the new areas from which well known diseases of vegetables and field crops have been reported to the Survey for the first time.

Disease	Host	Place where found
Angular spot	Tobacco	Connecticut, South Carolina (Prior to 1921 reported only from Virginia - now known in nine states.)
Wildfire	"	New Hampshire, New York, Florida
Mosaic	Celery	New Jersey (Is spreading, now in Indiana and Minnesota.)
Bacterium vesicatorium	Tomato	Kansas
Rust (Uromyces)	Pea	Minnesota (Previously reported from Nebraska and North Dakota.)
Yellows	Celery	New York, Pennsylvania (In New York one man lost 100,000 plants through this disease.)

Ecological observations

Ecological factors have an important bearing on the severity of many diseases. This is suggested particularly in the summaries of downy mildew of lettuce, potato mosaic, late blight of potato, black leg of potato, and onion smut. Septoria pisi has been reported on peas only from the northern states although a trace was reported from Texas one year. It would be interesting to know whether it occurs in other southern states or whether the temperature limits it to the North. Septoria lycopersici is most severe south of Pennsylvania and the Ohio River and east of the Mississippi. Tomato wilt (Fusarium lycopersici) was found on both sides of the lower Mississippi and Ohio Rivers. An epidemic of Macrosporium solani in New York, Illinois, and West Virginia was reported. What were the factors influencing this outbreak?

New Diseases

Table 2. New diseases reported during 1922. (See following text for details.

Host	Place	Disease	Reporter
Carrot	Texas	Rio Grande disease	Taubenhaus
Spinach	Washington, Oregon	Puccinia subnitens	Barss (Alkali grass the telial host growing near. Often reported before on different Chenopodiums but never on spinach.)
Swiss chard	Texas	Bacterial	Taubenhaus
Spinach	Idaho	Fusarium (stunting)	Hungerford
Lettuce	Florida	Alternaria	Foster
Potato	Pennsylvania	Giant hills	Nixon
Radish	Missouri	Erysiphe polygoni	Maneval
Chinese Cabbage	Texas	Aphelenchus olesistus	Taubenhaus (A leaf nematode)
Bean	Published in Science	Bacterium flaccumfaciens	Hedges
Watermelon	U. S. D. A.	Pythium (blossom end)	Drechsler
Watermelon	Washington	Rhizoctonia	Heald
Sweet potato	Texas	Macrosporium solani	Taubenhaus
Tomato	California	Basisporium gallarum	
Tomato	California	Alternaria	
Tobacco	Wisconsin	Bacterial leaf spot	

Yellow dwarf which has been described in New York is one of the most menacing of the newer potato diseases. It evidently does not come under the mosaic or leaf roll types. It is not only carried in the seed but is also carried in the soil and when once introduced into a field, remains indefinitely. The disease has been found in nearly every county in the state and has been seen in New Jersey, Pennsylvania, and Vermont.

Work on the mosaic diseases

Great effort has been applied to the work with degeneration type of diseases. The transmission of the disease from one host to another has received much attention. The lack of agreement on this subject is made evident by the statements of Elmer, Fernow and Valleau. (See mosaic diseases of potato and tobacco.)

The most talked about work has been done in an attempt to discover the cause of mosaic. The reader is referred to the work of Palm, Smith, Kunkel, Nelson, McKinney and others. (See potato mosaic.)

The division of the degeneration diseases of potato and the names applied by different workers give one an impression of the complicated nature of the problem. Some of the names are as follows:

Mosaic
Mosaic dwarf
Mild mosaic
Mottled curly dwarf
Calico
Leaf drop
Stipple streak
Leafroll
Severe mosaic
Rugose mosaic
Curly dwarf
Giant hills
Russet dwarf
Spindle sprout
Leaf rolling mosaic
Mottled mosaic
Spindle tuber
Marginal leafroll
Crinkle
Streak

In connection with mosaic, Miss Patch raises the question whether or not some of the other 21 sucking insects found on potatoes do not carry the inoculum as well as do the aphids. It has been observed that mosaic spreads when no aphids are present.

Newhall has found that lettuce mosaic is carried in the seed and is transmitted by means of potato aphids. In many other hosts the mosaic is seed-borne. The question arises as to whether the way in which the seeds are attached to the mother plant has a bearing on mosaic transmission.

Varietal susceptibility notes

Dr. H. E. Thomas at Ithaca, New York, inspected 54 varieties of celery in the vegetable gardens and found that all of them were about equally susceptible to late blight.

Newhall reports that the Los Angeles variety of lettuce was so susceptible to mildew that it was not profitable in New York.

Table 3. Resistant varieties of vegetables and other crops which were mentioned in Survey reports.

Crop	Place	Disease	Resistant variety
Asparagus	Boston	Rust	Martha and Mary Washington
Beans	New York	Anthraonose	Well's Red Kidney
Beans	Michigan	Mosaic	Michigan Robust Pea
Beans	New York	Root rot	Breeding work being done
Beans	New York	Bacterial blight	" " " "
Cabbage	Wisconsin	Yellows	Strains of various types
Celery	Michigan	Yellows	Strains of Gold. S. Blanch.
Lettuce	New York	Bottom rot	Long stemmed Boston head
Potato	New York	Late blight	Ekishirazu
Potato	Pennsylvania et al	Wart	Many varieties
Spinach	Virginia	Mosaic	Virginia Savoy

Crop	Place	Disease	Resistant variety
Sugar cane	Argentina	Mosaic	Kavangire
Sweet potato	New Jersey et al	Stem rot	Triumph
Tobacco	Kentucky	Root rot	Strain of White Burley
Tomato	U. S. D. A.	Wilt	Norduke, Norton, Marvel, Columbia, Arlington.
Tomato	Louisiana	Wilt	Red, Louisiana Pink
Tomato	Tennessee	Wilt	A 16-2

Progress in the development of control measures

Soft rots of vegetables:

According to a Pennsylvania bulletin, Sclerotinia libertiana will die in the soil in two years if no susceptible crop is grown.

Bacillus carotovorus seldom attacks carrots in the growing stages, according to a report from New Jersey. Carrots are attacked only when left in the ground too long. They should be harvested as soon as possible.

Soil and seed treatment:

Osmun and Anderson, of Massachusetts, have developed a new type of tank for regulating the flow of formaldehyde when it is applied for the control of onion smut. The top of the tank is air-tight, the air being admitted near the base of the tank from a pipe which extends parallel with the tank and which is as tall as the latter. They have also prepared various sized discs which will determine the rate of flow of formaldehyde and may be regulated according to the speed with which the farmer walks.

Favorable results in the use of inoculated sulphur for the control of potato scab have again been reported from New Jersey. Other states report variable results. Evidently difference in soil, climate, and other environmental factors have a bearing upon the application of sulphur. The control of Cystospora batata of sweet potato has also been accomplished in other states by the use of 300-400 pounds of inoculated sulphur applied just previously to the making up of the ridges. Sulphur has also been used in Kentucky in the preserving of cut potato seed. The results were so satisfactory that a large amount was ordered for this coming season's crop.

Martin, of New Jersey, used sulphate of ammonia as compared with nitrate of soda in the control of scab. The former gave very satisfactory results.

Walker, of Wisconsin, has found that treating cabbage seed at 50° C. for 30 minutes will eliminate the black leg organism from the seed. This is a very drastic treatment, but will mean a saving of thousands of dollars for the seed growers who are making heroic attempts at getting clean seed. A number of seed growers are also treating their seed with hot water 55° C. for 10 minutes. This controls black rot, most of the black leg, and also eliminates the Alternaria which the corrosive sublimate does not do.

Mosaic control:

Gardner, of Indiana, has shown quite conclusively that when the solanaceous weeds, such as ground cherry and horse nettle, are eradicated and care taken that no old tomato plants are left in greenhouses where seedlings are grown, tomato mosaic can be almost entirely eliminated.

Potato tuber indexing:

Perry, Blodgett and Fernow, of New York State, have done much work with indexing potato tubers for the elimination of degeneration diseases. This seems to be the only method remaining which will furnish a source of clean seed which may be used for the growing of certified stock.

Dusting:

The question of using dust instead of spray has been raised quite generally, especially since dust is so convenient to apply and appeals so strongly to the average grower. Quite variable results have been obtained in different states. Dye and Newhall, in New York, obtained almost perfect results when dusting celery; while Poole, in New Jersey, reports dust as worthless. The control of Alternaria of cantaloupe was only fair with dust. Cardinell and Page, in Missouri, report excellent control in the use of dust of watermelon anthracnose. Out of 150 rows 32 were treated,- 80% of the melons were picked from these 32 rows. Martin, in New Jersey, had much better control with Bordeaux. Martin also obtained very beneficial results when using calcium caseinate. Anderson, in Massachusetts, was able by spraying or dusting to control tobacco wildfire in the seed beds. Checks showed up to 92% disease, while the dusted showed not over 1%.

Sweet potato certification:

A number of plant pathologists and others interested in sweet potato growing met in a conference at Atlanta, Georgia. At that time they drew up certain resolutions which suggested that a voluntary certification system be planned in each of the sweet potato states, and that at least two inspections be made. Following are the states which have reported a sweet potato certification program: New Jersey, Maryland, Tennessee, South Carolina, Georgia, Florida, Alabama, Mississippi, and Arkansas. Louisiana and Texas say they have no such work started yet. In nearly all cases the work is based on that which was begun in Arkansas. Three inspections are made.

POTATO

Seed Certification

Seed certification is being practiced more widely each year, according to A. G. Tolaas, who gave a summary of the work in 1922. (Potato Assoc. Amer. Boston meeting.)

In addition to the table given below, Valleau makes the following report of potatoes grown late in the summer for seed in Kentucky:

Jefferson County - 47 applications - 150 acres - Passing all inspections
25 applications - 80 acres - 2420 bushels for sale
Shelby County - Passing all inspections - 2 applications - 11 acres - 735 bushels for sale.

The following quotation taken from the Clip Sheet (No. 204, May 22, 1922) of the Department of Agriculture indicates somewhat the extent to which certified seed is planted and the beneficial results from its use in Louisiana:

> "This year 22 carloads of certified seed potatoes, all of the Triumph variety, were planted in Louisiana alone. Twelve carloads came from Wisconsin and 10 from western Nebraska. It is claimed that by the use of this high-grade seed the yields

in that State are being increased 40 bushels or more an acre over that of much of the seed formerly sold there."

(For a more detailed discussion of seed certification, see Plant Disease Bulletin Supplement 22: 257-262. 1922.)

Table 4. Summary of potato seed certification in the United States and Canada in 1922. Data given by A. G. Tolaas, at the Boston Meeting of the Potato Association of America.

Place	Men or agencies handling inspection	Applications	Acreage	Certified			
				No. fields	Acreage	Bushels	No. inspections
Brit. Col.	Dept. Agr.	135	180	170	105	10,000	4
Alberta and Saskatchewan	University of Saskatchewan	100	1,500	100	300	2,000	
New Bruns.	Dom. Expt. Farms	520	4,000	130	1,325		
P. E. I.	Dept. Agr.	450	3,000	530	2,300	130,000	
Canada	Div. Bot., Dept. Agr.	1,219	11,250	1,732	6,642	299,665	4
Maine	Sta. Dept. Agr.	240	2,802	75	1,189	297,250	3
Vt.	Sta. Dept. Agr.	277	1,100	96	588	125,000	3
New York	Col. Agr., Dept. Pl. Path.	208	1,803		1,132	256,127	3
New Jersey	Sta. Potato Assn.	103	762	52	288	46,120	3
Penna.	Bu. Pl. Ind.	187	988	85	316	67,827	5
Mich.	Mich. Potato Producers' Assn.	532	3,196	420	2,429	315,758	4
Wis.	Hort. Dept.	560	4,225	325	2,000	400,000	5
Minn.	Sta. Dept. Agr.	441	3,530	330	2,671	338,100	4
N. Dak.	Sta. Seed Com.	833	8,615				2
Nebr.	Dept. Hort.	298	4,500	120	1,800	84,000	4
Colo.	Sta. Horticulturist	110	800	41	500	84,000	3
Mont.	Hort. Dept.	208	975		175		2
	Flathead County Potato Improvement Association	38	301	14	143	5,720	6
Utah	Sta. Bd. Agr.	25	75		17	2,000	2
Idaho	Com. of Pure Seed	798	4,086	190	1,464		3
Wash.	Sta. Dept. Agr.	188	1,210	39	216	26,600	4
Ore.	Agr. Coll.	290	2,992	51	550	10,000	3
Calif.	Sta. Dept. Agr.	40	1,534	34	1,384	100,000	3
Total		7,800	63,424	4,534	27,534	2,600,167	

References

Anon. Standard for seed potatoes. Potato Mag. 47: 18. February 1922.

Tice, Cecil. Seed potato inspection and certification in British Columbia. Scient. Agr. 11: 249-251. April 1922.

__________ Seed-potato certification in British Columbia. Potato Mag. 40: 6. 1922.

Tolaas, A. G. Minnesota potato certification rules. Pot. Mag. 49: 10-18. 1922.

Late blight caused by *Phytophthora infestans* (Mont.) De Bary

Late blight, although severe in New England and New York in 1922, was much less destructive than in the seasons of 1919 and 1920. In these years the average losses in eight states where blight was of great importance were 18 and 20%, respectively, while in 1922 the corresponding loss was only 8%. In 1921 there was almost no injury due to *Phytophthora infestans*. During the present season the disease was reported from all the states along the Atlantic Coast from Florida to Maine and along the northern tier of states as far west as Wisconsin. There was only a trace in northwestern Washington. In the East the heavy rainfall in June and first part of July caused such early infections that a large percentage of loss was due to the killing of the vines, rather than the rotting of the tubers.

Table 5. Percentage loss from potato late blight in states where losses were heavy.

State	Prevalence compared with: Last Year	Average Year	Percentage loss	Range within State
Maine	-	-	5 or less	General
New Hampshire	More	More	15	General
Vermont	More	More	15-25	General, except Lake Champlain Valley
Massachusetts	More	More	10	General
Connecticut	More	More	6	General
New York	More	More	5-10	General
New Jersey	More	More	2.5	North and central part
Pennsylvania	-	-	5	Northern tier of counties especially
Maryland	Less	Less	2-3	
West Virginia	-	-	t	Central section
Georgia	-	-	1	
Tennessee	-	-	5	
South Carolina	-	-	2	
Michigan	-	-	1-3	Upper Peninsula
Wisconsin	-	Same	t	Widely scattered

Other states reporting the disease were Delaware, Florida, Ohio and Washington.

The following states reported that no late blight was observed: Mississippi, Illinois, Minnesota, Indiana, Iowa, North Dakota, South Dakota, Kentucky, Louisiana, Arkansas, Idaho and Oregon. Prof. Bolley of North Dakota writes further that "North Dakota has never experienced any attack of the so-called late blight. I have never in my life here in the state seen more than one case of late blight."

Table 6. Dates of earliest appearance of late blight in the United States in 1922, according to collaborators.

Date	Place	Date	Place
May 23	Martin's Point, So. Car.	June 23	Monmouth County, New Jersey
June 18	Nassau County, New York	July 2	Tucker County, West Virginia

Date	Place	Date	Place
July 7	New Durham, New Hampshire	July 25	Amherst, Massachusetts
July 7	Milford, Connecticut	July 28	Maryland
July 17	Wayne County, Pennsylvania	August 4	Oceana County, Michigan
July 18	Rutland County, Vermont	August 14	Blacksburg, Virginia
July 20	Colby, Wisconsin		

The following extract from a recent paper by Donald Reddick (1) indicates that there are possibilities of securing late blight resistant varieties:

> "The potato variety Ekishirazu has been tested in greenhouse and field at Ithaca, New York. In a cool house it grows luxuriantly and produces large tubers. In a warm house it makes very poor growth and produces many small tubers. Both in 1921 and 1922 its growth in the field corresponded to that of the warm house. The variety has been subjected repeatedly, both under glass and out of doors, to extremely favorable conditions for infection by Phytophthora infestans. Occasional small lesions have been produced but conidiophores on lesions of attached leaves have been found only once."

It has long been known that rainfall and humidity have a very important bearing on the amount of late blight on potatoes. This fact is again confirmed for the present season. In northern New York and along Lake Champlain Valley in Vermont the blight was reported as very slight. Similarly the southern part of Michigan was comparatively free from the disease, while fields in the northern part were more severely affected. A glance at the Map (Fig. 1) showing the precipitation for July when most primary infections are reported, will show that the areas where blight was unimportant received less rainfall than the remaining sections.

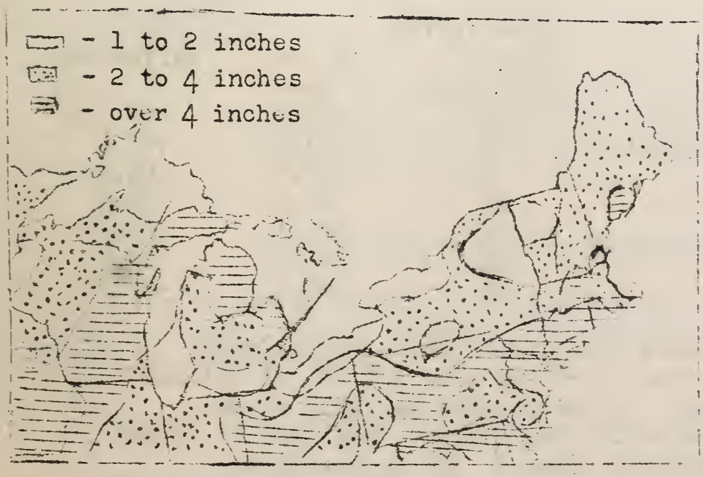


Fig. 1. Precipitation map for July, 1922. From Monthly Weather Review.

The question arises concerning other factors that may influence the growth and development of Phytophthora infestans. It has already been shown by Melhus that the conidia germinate best at temperatures ranging from 5-13° C. (41-54°F.). Probably the New England States, New York and northern Michigan always have a minimum temperature, especially at night, which gives optimum conditions for germination. This is followed by warm humid days permitting the mycelium to progress in the leaf. Farther south, however, this low temperature may not always prevail.

Table 7. Mean monthly minimum temperatures for different parts of Pennsylvania, Ohio and Michigan during the months of July and August, 1922. (Monthly Weather Review)

Place	Mean Minimum Temperature (°F) July	Mean Minimum Temperature (°F) August	Place	Mean Minimum Temperature (°F) July	Mean Minimum Temperature (°F) August
Pennsylvania:			Michigan:		
Philadelphia (south)	58	56	Ludington	46	45
Harrisburg (south)	58	55	Saginaw	45	47
Reading (south)	58	54			
Scranton (north)	49	49	Ohio:		
			Dayton	51	52
Michigan:			Cleveland	52	51
Sault St. Marie	42	40	Sandusky	54	53

Above is a table giving the minimum temperatures of different parts of Pennsylvania during the months of July and August, as well as comparing those of Ohio and Michigan. Ohio had as much rainfall as Michigan, but late blight was not present in the former. Central Pennsylvania, likewise, had as much rainfall as its northern tier of counties, but late blight was reported from the latter. The tabulation is not given as facts which have been definitely established but rather as a possible suggestion, since the temperatures coincide so nearly with those which Melhus found were optimum for Phytophthora infestans.

Late blight control

New Jersey: "In a spraying test on commercial crop, American Giants in Monmouth County, home made Bordeaux mixture gave an increase of 69 bushels per acre as compared with 26 bushels for a commercial Bordeaux. Practically all of the increase is attributed to late blight control."

Treatment	Dead leaves Aug. 2 Per cent	Bu. per acre	Difference
Check (unsprayed)	92	280.9	--
5-5-50 Bordeaux mixture (3 applications)	77	271.8	-9.1
Bordeaux mixture (7 applications)	5	350.3	69.4
Commercial Bordeaux (7 applications)	24	307.4	26.5
Commercial Bordeaux (dust)	72	301.1	20.2
Copper-lime (3 applications)	91	300.7	19.8
Copper-lime (7 applications)	70	263.7	-20.2

"Included in this test were three plots sprayed with a home made Bordeaux mixture (5-5-50) plus 3/4 lb. of calcium caseinate to 100 gallons. In every case the yield of the plots sprayed with the material was greater than that of plots sprayed with Bordeaux mixture above." (W. H. Martin.)

Michigan: "It is evident that Bordeaux mixture is far superior to Bordeaux-like dusts, and that its application brings high returns in increased yields." (Coons and Kotila)

Recent literature

(Cited)

1. Reddick, Donald. Ito's potato variety Ekishirazu in New York. Phytopath. 13: 55-56. 1923.

(Not cited)

Bedford, W. L. Potato blight. Fruit flower & Veg. Trades Jour. 42: 5-6. 1922.

Bisby, G. R., E. E. Clayton, W. H. Martin, J. T. Rosa, Jr., E. A. Stokdyk. The cooperative potato spraying project: report for 1921. Phytopath. 12: 241-248. May 1922. (July)

Bruyn, Helena, L. G. The saprophytic life of Phytophthora in the soil. Mededeelingen van de Landbouwhoogeschool. 24^4: 1-37. 1922.

Has cultivated P. infestans on soil in laboratory. Has cultures on clay 11 months old and fungus still viable and pathogenic.

Culver, G. E. Bordeaux used with profit on potatoes. Michigan Sta. Quart. Bul. 4^4: 134-135. 1922.

Dickson, B. T. Diseases of potato. Scient. Agr. 2: 202-206. Feb. 1922.

Kotila, J. E. and G. H. Coons. Spraying and dusting of potatoes in 1922 at Chatham, Michigan. (Abstract) Phytopath. 13: 54. 1923.

Link, G. K. K. and F. C. Meier. Late blight tuber rot of the potato. U.S. Dept. Agr. Dept. Circ. 220: 1-5. 1922.

Martin, W. H. Report of potato spraying tests. Ann. Rept. New Jersey Agr. Exp. Sta. 41: 577-587. 1921.

Murphy, P. A. The bionomics of the conidia of Phytophthora infestans (Mont.) de Bary. Sci. Proc. Roy. Dublin Soc. n.s., 16: 442-466. Feb. 1922.

"Conidia of Phytophthora infestans when mingled with soil and kept out of doors may remain viable and capable of infecting potato tubers for a period of between three and four weeks."

Pennington, S., and H. G. Robinson. Spraying of potatoes for "blight" or "potato disease" (Phytophthora infestans). Bul. Univ. Col. Reading 30: 1-8. 1921.

Pethybridge, G. H. Some recent work on the potato blight. Rept. Int. Potato Conf. Roy. Hort. Soc. (England) 112: 126. 1921.

"The role of resting spores in the life cycle under field conditions remains unknown, but there is some evidence that they exist and are responsible for some otherwise unexplainable outbreaks of blight."

Early blight caused by Macrosporium solani E. & M.

Early blight of potatoes was present in nearly every state, but caused relatively slight injury. Comments from different states on prevalence of the disease are as follows:

Maine: Very severe in certain fields near Corinna. (F. Weiss)

New Hampshire: More than usually prevalent, many fields prematurely killed. (Butler)

Delaware: Very prevalent throughout state. Heavy rains associated with its severe prevalence on early crop. (Adams)

Kentucky: The occurrence of early blight is spotted. Some sections entirely swept as early as September 25; in others, no more than 20% at killing frost. (J. S. Gardner)

Georgia: Well distributed in state, causing considerable loss. (McHatton)

Ohio: Very little of this disease is to be found in northern Ohio, yet is general in the southern portion of the state. (Thomas)

Illinois: Occurring throughout the state, and causing serious losses in some instances. Our most common and most destructive potato disease. (Tehon)

Michigan: Exceptionally prevalent, beginning in the early part of September and causing shortening of crop. Sprayed fields, unless spraying continued late in September, showed blight. Loss less than 1921. (Bot. Exp. Sta. Mich. Agr. Coll., October 15)

Minnesota: Heavy infections reported from the northern part of the state and the Red River Valley. (Section of Plant Pathology)

North Dakota: Distinct target board lesions have been found in several fields this year, and I think it is safe to say that the disease is much more common than in previous years. Spraying with Bordeaux has not been commonly practiced. (Weniger)

Utah: Early blight is becoming a rather serious factor in certain areas in the state. In Cache County a number of fields showed this in such a severe form that plants were killed three weeks earlier than death normally occurs. (Richards)

Oregon: Not reported even from the Coast section this year. If present (as probable) is negligible in the state. (Barss)

Table 8. Percentage loss from, and geographic range of, early blight as reported to the Plant Disease Survey, 1922.

State	Prevalence compared with		Percentage loss	Geographic range
	Last Year	Average Year		
Maine	-	-		Present
New Hampshire	-	More		Southern half of state
Vermont	-	More	2-5	General
Massachusetts	-	Less	t	"
Connecticut	More	More	2	
New York	Same	Same	t	"
Pennsylvania	-	-	1	
New Jersey	Less	Less	t	"
Delaware	More	Same	1.5	"
Maryland	Same	Same	.5	Eastern part of state
Virginia	-	-	1	
West Virginia	-	-	t	General

State	Prevalence compared with		Percentage loss	Geographic range
	Last Year	Average Year		
Kentucky	Less	Less	15 (fall crop)	
South Carolina	-	-	Unimportant	General
Georgia	More	-	1	"
Mississippi	Less	Less	1	"
Louisiana	-	-	t	
Texas	-	-	Unimportant	
Arkansas	-	-	0	
Ohio	-	-	Slight	General in southern section
Indiana	-	-	Not serious	
Illinois	Same	Same	1	
Michigan	More	Less		
Wisconsin	Less	Less	t	General
Minnesota	More	Same	Not serious	
Iowa			Unimportant	
North Dakota	More	More	.5	Eastern half of state
South Dakota			t	
Kansas			.5	
Colorado	-	Same		
Arizona	-	-	Common	
Utah	-	-	.5	
Idaho	Same	-	t	
Oregon	-	-		Present
Washington	-	-	0	

Table 9. Dates of earliest recorded appearance of early blight, 1922.

Date	Place	Date	Place
May 1	John's Island, South Carolina	July 9	Ipswich, South Dakota
May (last of)	Kansas	July 21	New Castle County, Delaware
May 7	Holmes County, Mississippi	July 22	Webster, North Dakota
June 8	St. Clair County, Michigan	July	St. Johnsburg, Vermont
June 10	Salem County, New Jersey	July	Nassau County, New York
July 1	Derry, New Hampshire	Aug. 1	Starks, Wisconsin
July 5	Isanti County, Minnesota	Sept. 1	Kentucky
July 7	Milford, Connecticut		

Comments on susceptibility of varieties:

Connecticut: Most on early varieties.

Kentucky: The early planted Cobblers suffered worst. A strain of Cobbler, grown by Jacob Klingenfuss, Jeffersontown later in maturing and a decidedly heavier yielder than the majority of Cobbler strains in Jefferson County, takes the blight so late as to almost justify its reputation as being "blight proof." (J. S. Gardner)

Wisconsin: Scattering infection in many fields of Green Mountain and Early Ohio. None seen on Rural New Yorker. (Vaughan)

Minnesota: In two neighboring fields very heavy infection was observed on Bliss Triumphs but very little on Ohios.

Control measures:

New York: Early blight is harder to control either by spraying or dusting than late blight. (Chupp)
Long Island. Quite prevalent and very little control from spraying. Am becoming convinced that our ordinary potato spray procedure is ineffectual against the disease. (E. E. Clayton)

New Jersey: Early blight was abundant on the late crop planted for seed. A spray test was conducted at Elmer where a comparison was made of home made Bordeaux mixture prepared with stone lime and with hydrated lime, also with and without a casein spreader. An examination of the plots on Oct. 18 showed dead leaves to be present on the various plots as follows: Check 52%, hydrated lime 5%, Stone lime 0, Stone lime and spreader 0. On the last two treatments no early blight was found, there was considerable on the plots sprayed with the hydrated lime Bordeaux, and the check plots were heavily infected. The yield of the various plots follow: Check 150.6, hydrated lime 156.2, Stone lime 167.1, Stone lime and spreader 164.8. The small differences in yield may be accounted for on the ground that the season was very dry and the crop was killed by frost early in its development. (W. H. Martin)

Kentucky: Spraying potatoes (fall crop) with 5-5-50 either with traction or engine power has resulted in about 25% increase in yield in several cases. This is probably due nearly entirely to control of early blight late in the fall while tubers are making most rapid growth. (Valleau & Gardner)

Four applications were made of Bordeaux calcium arsenate dust on four acres of fall potatoes at a cost of $12 per cwt. of dust. The four acres dusted averaged 30 bushels per acre more than undusted which was about 135 bushels per acre. (Gardner)

Kansas: Control by spraying and dusting gave inconclusive data. (R. P. White)

Arizona: Bordeaux spray excellent where three applications were made.

Fusarium wilt caused by Fusarium oxysporum Schlecht.

Fusarium wilt evidently is present in nearly every state where potatoes are grown commercially, although none of the collaborators report heavy losses. In none of the states was the disease general, the Fusarium being limited to certain areas.

Table 10. Losses due to Fusarium wilt, according to collaborators, 1922.

State	% loss	State	% loss	State	% loss	State	% loss
Massachusetts	Trace	South Carolina	Trace	Ohio	5	Iowa	6
New York	1.5	Kentucky	1	Indiana	.5	N. Dak.	2

State	% loss	State	% loss	State	% loss	State	% loss
Pennsylvania	5	Mississippi	1	Wisconsin	0	Utah	3.5
Maryland	.5	Texas	1	Minnesota	.5	Idaho	1
		Arkansas	t			Washington	t

Other states from which the disease was reported are New Jersey, Florida, Michigan, Missouri, South Dakota, Kansas, Montana and Colorado.

Both the seed tubers and the soil are sources of infection for the new crop. According to the reports given below the organism is very commonly present in the soil:

Missouri: That infection is mostly soil-borne is indicated by the fact that most of this disease occurred where potatoes had been grown 2 to 15 years previously. (Maneval)

Kansas: Kansas potato soils are apparently heavily infested with this organism, for Kansas potatoes, if stored, show high percents (80% approx.) of internal vascular browning, from which F. oxysporum can readily be isolated. No case of wilt in the fields has been noticed, however, due probably to some ecologic factor. (R. P. White)

Very little is reported regarding the ecological influences upon the severity of the disease. It is generally considered that high temperatures determine in a great measure the amount of injury produced. The following reports uphold this statement:

New York: Occurs wherever potatoes are grown, but most serious in Hudson Valley. Soil infestation and warmth of the weather are more important than the fact that the seed is infected. (Chupp)

Pennsylvania: Eastern part of state. Worse on limestone soils and following Rhizoctonia. (Nixon)

Michigan: Common in northern part of state; whole fields dying early. Believed to be correlated with high soil temperatures. (Bot. Exp. Sta., Mich. Agr. Coll.)

The following quotation by Miss Wanda Weniger (1) of North Dakota, is interesting:

> "During the past three years cultural studies of stem-end discolored tubers from nearly every potato growing section of the state have been made with a view of determining the cause and nature of vascular discolorations. The tubers studied were mostly of the Early Ohio variety, all showing a distinct browning of the vascular tissues when cut across about one-fourth to three-eighths of an inch from the point of rhizome attachment. Cultures were made from tissue taken at an average depth of one-half inch from the point of attachment and at least three made from each tuber. Fusarium

> wilt was found associated with less than one-half of the discolorations, and was not as is popular belief, the sole cause of discolorations. Many tubers, although showing a distinct browning, gave no growth of any parasitic organism, while others showing little browning gave the Fusarium wilt fungus. In a large percentage of tubers the blackleg bacillus was found, while in some both blackleg and wilt were present. These discolorations, whether yielding growths of Fusarium wilt, of blackleg, of both wilt and blackleg, or of no organism, were not distinguishable either in color or extent."

Table 11. Dates of earliest appearance of Fusarium wilt in the United States in 1922.

Date	Place	Date	Place
May 1	John's Island, South Carolina	July 7	Floyd County, Indiana
May 6	Gulfport, Mississippi	July 14	Sullivan County, New York
June 6	Carroll County, Ohio	July 20	Becker County, Minnesota
June 19	Missouri City, Missouri	July	Brookings, South Dakota
June 20	Hightstown, New Jerseym		

Varietal Susceptibility

Although no variety of potatoes has been found immune, or even distinctly resistant to Fusarium wilt, there are certain occasions when one variety will show less disease than another variety planted under similar conditions. Following are two reports concerning this:

Kentucky: Some strains of Cobbler show as much as 3% of Fusarium wilt. Generally less than 1% in selected stocks. (J. S. Gardner)

Georgia: This disease has been reported from many counties and seems to be especially prevalent on the Red Bliss and Early Rose potato. The Irish Cobbler seems to be the most resistant variety. (J.H. Miller)

Control Measures

According to Miss Wanda Weniger, in North Dakota best control was obtained by selection of seed tubers, cutting the stem ends.

References

(Cited)

1. Weniger, Wanda. Studies on the causes of stem-end discolorations of potato tubers in North Dakota. Phytopath. 13: 55. 1923.

(Not cited)

Dickson, B. T. Diseases of the potato. Scient. Agr. 2: 310-312, 325-327. May 1922.

Goss, R. W. Temperature and humidity studies of some Fusaria rots of the Irish potato. Jour. Agr. Res. 22: 65-79. 1922.

"Fusarium oxysporum, F. tricothecioides, F. radicicola were used in inoculation experiments at controlled temperatures and humidities. At 25° C. all produced more or

less rotting, the rapidity varying with the humidity. At lower temperatures humidity was the controlling factor in producing rot. Old tubers are most susceptible."

McKay, M. B. Transmission of some wilt diseases in seed potatoes. Jour. Agr. Res. 21: 821-848. 1921.

Mann, H. H. and S. D. Nagpurkar. Further investigations on the Fusarium blights of potatoes in western India. Agr. Jour. India 17: 564-576. November 1922.

Soil remains very infective after three months and six months. After nine months attack is very much less.

Botany and Plant Pathology. Fusarium wilt of potato. Pa. Sta. Bul. 170: 15-20. 1922.

"Studies of wilt of potatoes have shown that three species, Fusarium oxysporum, F. eumartii, and Verticillium sp., are involved in the wilt problem, and that most of the infection comes from the soil." (Abst. E.S.R. Oct. 1922)

Wart caused by Synchytrium endobioticum (Schilb.) Percival

Very little additional information regarding the spread of wart has been obtained. The disease has been surveyed so closely that few, if any, evident infested areas remain unknown. For the detailed report of the geographic distribution of this disease, the reader is referred to the Plant Disease Survey Bulletin Supplement 16: 190-193. 1921 and Supplement 22: 279-284. 1922. In addition to the infested areas mentioned previously may be included the localities given in a report from Maryland:

> "Wart was found in six new gardens, five of which were located at Lord and one at Eckhart Mines. No cases found outside of quarantined areas." (Temple & Jehle, Sept. 1) (See Pl. Dis. Bul. 6: 69. Aug. 15, 1922 for map of quarantined areas.)

The danger of having the fungus spread is well express in the following quotation (from U. S. Dept. Official Record 1^{28}: 3. July 12, 1922):

> "Studies of this problem, which have been carried on for two years and are now nearing completion, indicate that the fungus causing wart disease is so closely adapted a parasite that the environment which most favors its host is best for its own development also.
>
> "A comparison of weather records for the eastern Pennsylvania infested area with those of the principal potato sections of the United States shows that in respect to rainfall and temperature conditions during the growing season for late potatoes the wart-infested areas are in no way unique; nor are potatoes successfully grown in any region where the climate ordinarily is warmer and drier than was the season of 1921 in eastern Pennsylvania, where wart developed only slightly less severely than usual.
>
> "It seems likely that wart disease might gain a foothold even in our early potato districts."

References

Anon. Wart disease attacking the tomato. Gard. Chron. III, 71: 62. Feb. 11, 1922.

Anon. Wart disease of potatoes immunity trials. Gard. Chron. III, 72: 229. Oct. 14, 1922.

> "It was found that selfed immune varieties produced a large number of immune seedlings, and that in many respects these reproduced the characteristics of the parents, and that in a few cases..... they were indistinguishable from the parents, and showed a high percentage of immune individuals."

Blackman, V. H. The nature of immunity from wart disease. Rept. Internat. Potato Conference. p. 92. Roy. Hort. Soc.: London, 1921 (1922).

> ".....as yet there is no certain knowledge as to whether resistance depends on anatomical or physiological factors."

Brierly, William B. Some research aspects of the wart disease problem. Rept. Internat. Potato Conference. p. 93-104. Roy. Hort. Soc.: London, 1921 (1922).

> "Immune varieties, stability of host and of fungous parasite, nature of immunity to disease, relation between disease and external factors, and soil sterilization are discussed in relation to the wart disease."

Botany and Plant Pathology. Potato Wart. Penn. Sta. Bul. 170: 15-19, 19-20. 1922.

Botjes, J. Oortwijn, and H. M. Quanjer. Dutch potato varieties resistant to wart disease and internal brown spot. (Abstract) Phytopath. 13: 54. 1923.

Cuthbertson, William. The problem of immunity to wart disease in potatoes. Gard. Chron. III, 71: 104. March 4, 1922.

Dickson, B. T. Diseases of the potato. Scient. Agr. 2: 202-206. Feb. 1922.

de Toit, P. J. Annual report of the secretary for agriculture, year ended 30th June, 1922. Jour. Dept. Agr. South Africa 5: 480-517. Dec. 1922.

> "This disease was unfortunately discovered in Natal and its origin has not yet been traced. So far the disease has been found on two adjoining farms in the Impendhle Division. The Department has been enforcing for years stringent regulations against the introduction of this serious disease, which is prevalent in several countries of Europe. Careful inspection was immediately instituted by the Division of Botany as to likely sources of infection, but without success. Careful watch is being kept over the principal markets of Natal for infected tubers. The infected properties have, of course been quarantined and other necessary restrictive measures taken."

Doidge, E. M. Wart disease of potatoes: *Synchytrium endobioticum* Perc. Jour. Dept. Agr. So. Africa 4: 447-451. illus. May 1922.

> "In spite of quarantine, wart has been found in at least one locality in the Impendhle Division, Natal."

Esmarch, F. Der kartoffelkrebs, eine ernste gefahr fur den sachsischen kartoffelbau. Sach. Landw. Zeitschr. 70: 498-499. Oct. 28, 1922.

Foëx, E. La maladie verruqueuse de la pomme de terre ou galle noire. Jour. Agr. Prat. 149: 174-177. Aug. 26, 1922.

Oberstein, Otto. Beitrag zur prüfung von kartoffelsorten auf ihre widerstandsfähigkeit gegen dem kartoffelkrebs. Angew. Bot. 4: 72-74. March-April 1922.

Protzen, Karl. Die krebsfrage in physiologischer beleuchtung. Deutsche Obstbauz. 68: 62-73. Feb. 1922.

Salaman, R. N. and J. W. Lesley. Some information on the heredity of immunity from wart disease. Rept. Internat. Potato Conference. p. 105-111. Roy. Hort. Soc.: London, 1921 (1922).

Schaffnit, Ernst. Der kartoffelkrebs. Deutsche Obstbauz. 68: 212-213. June 1922.

Scotland Board of Agriculture. Testing of new varieties of the potato for immunity from wart disease. Scott. Jour. Agr. 5: 306-311. July 1922.

Spagnier, Henry. La galle verruqueuse des pommes de terre Jour. Agr. Prat. 86: 476-478. Dec. 9, 1922.

Spieckermann, Albert. Wie kann die weitere verbreitung des kartoffelkrebses in Deutschland verhindert werden? Landw. Zeit. 42: 371-372. Nov. 18, 1922.

Wart continues to spread in Germany. Is now known to occur on some potato farms, and a four-year rotation does not check it.

Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston meeting. 1922.

Trabut, Louis. La gale noire de pomme de terre ou maladie verruqueuse. Bull. Agr. Algerie-Tun.-Maroc. II, 28: 58-61. Feb. 1922.

Weiss, Freeman and C. R. Orton. Progress notes on potato wart disease investigations. (Abstract) Phytopath. 12: 38. 1922.

Leaf roll or mosaic does not affect immunity to wart disease.

Stem rot and scurf caused by *Corticium vagum* DC.

No disease is reported more often than Rhizoctonia, and in a large number of cases it is considered one of the serious troubles of potatoes. Space can be given only to a few of the typical reports regarding the injury and distribution of the disease.

Virginia: Rhizoctonia caused considerable trouble on the higher lands. This disease affected the germination and thereby reduced the yield of the crop. (T. C. Johnson, July 24)

Kentucky: Fall crop starting in hot weather not affected. The fact that the scurf is not found on Kentucky grown tubers most years indicates that infection in the spring crop probably comes from soil. (Valleau & Gardner)

North Dakota: Very abundant this year, being found in fields from untreated seed, improperly treated seed, and also from infected soil. The percentage of infected vines in fields is from 5-30. There is much evidence of dying off of sprouts while still underground. Dry stem rot and little potato have been abundantly observed. (Weniger)

South Dakota: Seems to be very prevalent; mostly late infection with some early deep pitted damage. (Evans)

Kansas: Everywhere potato is grown. Most important disease. (White)

Nebraska: Heavy infection early in season causing considerable killing of sprouts. One field 100 acres, 75% infected when plants 3" high. (Goss)

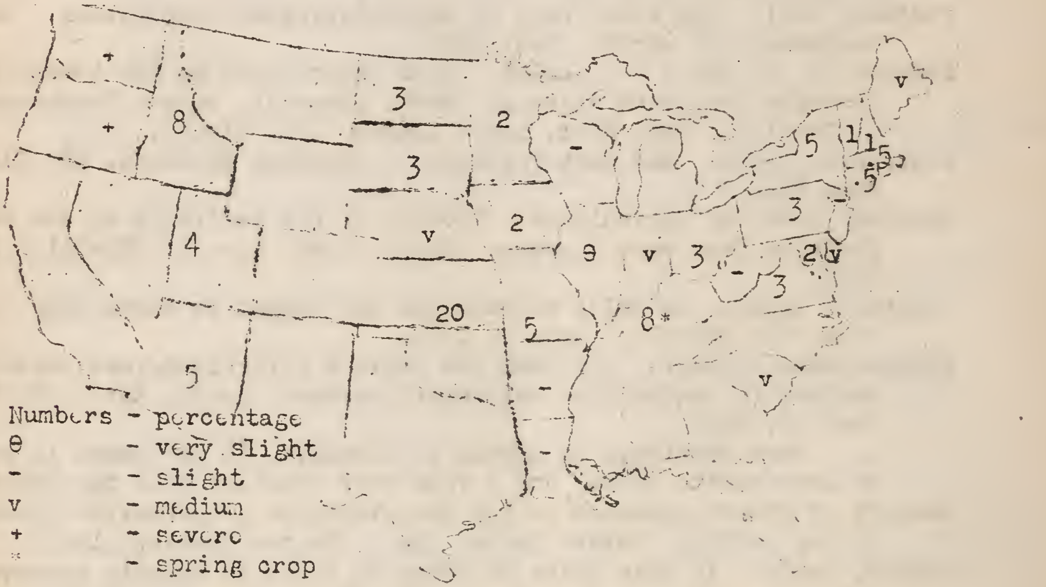


Fig. 2. Severity of, and estimated percentage losses from Rhizoctonia, 1922.

The amount of rainfall and the type of soil have an effect upon the seriousness of the disease, according to the reports from New Hampshire and Minnesota. The report from the latter state is of special interest since Wollenweber (Der kartoffelschorf. Arbeiten des Forschungsinstitutes für Kartoffelbau 2: 1-102. 1920. See 35.) argues that the fungus in soil rich with humus lives on the dead vegetable matter instead of on the potato plant. He states further that Rhizoctonia thrives best in acid soils, and can be held partly in check by the addition of lime to the soil.

New Hampshire: Poor stand in heavy soils due in part to attacks by black scurf. We had long continued and very wet weather following planting. (Butler)

Minnesota: General throughout the state, especially heavy on peat soil. (Section of Plant Pathology)

Table 12. Dates of earliest appearance of Rhizoctonia in the United States in 1922.

Date	Place	Date	Place
March 29	Pottawatomie, Kansas	May	Nassau County, New York
April	Louisiana	June 3	Hennepin County, Minnesota
May 1	John's Island, South Carolina	June 12	Champaign County, Ohio

Date	Place	Date	Place
June 18	Missouri	July 11	Wisconsin
June 23	Jefferson County, Illinois	July 20	Milford, Connecticut
June	South Dakota	September	New Castle County, Dela.
July 1	Kingston, New Hampshire		

In past seasons, different varieties have been named as being more susceptibile or more resistant to Rhizoctonia than others. In the reports of the present year nothing is said regarding varietal susceptibility. Seemingly no varieties are sufficiently resistant to attract special attention.

Control

The reports are unanimous in their statement that seed treatment was successful in the control of Rhizoctonia solani. There is a variation, however, in the methods which are applied. The cold corrosive sublimate solution is the most general disinfectant used. Hot formaldehyde appeals to those who have large quantities of tubers to treat. With the formaldehyde it is necessary to cover the tubers after dipping and this means that the potatoes must be handled twice. In order to avoid the double handling some experimental work has been done with hot corrosive sublimate, which has other advantages.

New York: Treatment with hot corrosive sublimate gave excellent results. (Chupp)

New Jersey: Seed disinfection with hot formaldehyde and cold corrosive sublimate gave very good control of Rhizoctonia. (W. H. Martin)

Ohio: Reports which come to us regarding this disease show that only fields where seed treatment was not employed are causing any concern. (Thomas)

Wisconsin: $HgCl_2$ treated seed showed little Rhizoctonia. Very successful this year. (Vaughan)

North Dakota: Best results in control by selection, treatment with corrosive sublimate, and rotation. (Weniger)

Kansas: Seed treatment on 3000 acres reduced loss. Average increase due to treatment by sublimate method for this and other disease 40 bu. per acre. (E. A. Stokdyk)

Arizona: Mercuric chloride used in Santa Cruz Valley and in Northern Arizona, with good results. (J. G. Brown)

Idaho: In order to thoroughly test out the hot formaldehyde method of potato seed treatment, a series of treatments were conducted in the laboratory. The following table gives the methods of treatment and results that were obtained in the field.

Table 13. Comparison of the efficiency of hot formaldehyde and corrosive sublimate in controlling Rhizoctonia in Idaho, 1922.

Treatment	Rhizoctonia		Clean		Per cent
	Marketable	Culls	Marketable	Culls	Rhizoctonia
	Lbs.	Lbs.	Lbs.	Lbs.	
1. Check	235	23	64	7.5	78.3
2. Formaldehyde 50° C., 3 min. sprinkled and covered 48 hours	63	3	322	24	16.01
3. Formaldehyde 50° C., 2 min. sprinkled and covered 48 hours	50	7.25	312.25	32	14.25
4. Mercuric Chloride	21	2.75	409.25	36	5.06
5. Mercuric Chloride sprinkled and covered 48 hours	67.25	7	300	28	18.45
6. Formaldehyde 50° C., 2 min.	146	16	217.75	33.75	39.17
7. Formaldehyde 50° C., 2 min. sprinkled	58	2.75	344	33.75	13.85
8. Check	278.25	23.5	41.5	16.5	77.34

Average yield of all treated plots 384.83 lbs.
Average yield of two check plots 309 lbs.

The discrepancy between treatments five and six is unaccounted for, as results of the previous season's work in the field showed that sprinkling the tubers previous to treatment increased the efficiency of the corrosive sublimate. This was also the case in the laboratory. (C. W. Hungerford)

Oregon: General throughout the state and serious but the more general adoption of corrosive sublimate for potato seed treatment is bringing about some reduction in the amount of damage done from year to year. (Barss)

In Canada the results of seed treatment were not so encouraging as in the United States, according to Bisby, Higham, and Groh (1).

> "It will be seen from the following table that seed treatment had practically no influence on the amount of black scurf present; the limiting factor was the date of digging, as shown by the following list:

Dug	% black scurf	Dug	% black scurf
August 20	7.5	Sept. 6-7	88.5
" 26	54.0	" 8-9	94.4
" 30-31	56.3	Oct. 13	93.5
Sept. 1-2	70.8		

References:

(Cited)

1. Bisby, G. R., J. F. Higham, and H. Groh. Potato seed treatment tests in Manitoba. Scientific Agr. 3: 219-221. 1923.

(Not cited)

Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston Meeting. 1922.

> "Rhizoctonia has been shown to be a cool weather parasite, causing severe damage to sprouts down to the lower temperature limit at which potatoes will grow.
>
> The injury to sprouts, which is the most destructive form of this disease, does not occur at temperatures which are most favorable for rapid sprouting. This same fungus has been shown to be capable of producing a stem-end rot of elongated tubers which is jelly-like in the field and dry in storage."

Anon. Treating seed potatoes. Potato Magazine 4^{7}: 10. 1922.

Howitt, J. E. Experiments in the control of Rhizoctonia or black scurf of potatoes. Sci. Agr. 1: 256. 1921.

> "Treatment with solution of bichloride 1-500 for 2 hours gave perfect control; 1-1000 for same length of time reduced disfigured tubers to 14%."

Raeder, J. M. and Chas. W. Hungerford. The effect of presprinkling with water upon the efficiency of certain potato seed treatments for the control of Rhizoctonia. (Abstract) Phytopath. 12: 447-448. Sept. 1922.

> "Preliminary laboratory tests conducted at the Idaho Experiment Station have shown that the efficiency of both the corrosive and hot formaldehyde treatments for seed potatoes is greatly increased by first sprinkling the potatoes with water and covering for either 24 or 48 hours."

Richards, B. L. *Corticium vagum* as a factor in potato production. (Abstract) Phytopath. 12: 444. Sept. 1922.

> "Several strains of *Corticium vagum* were found to produce severe and characteristic cankers on all underground parts of the potato. All strains, though able to infect mature stems either with or without wounding, were found to attack the plant most vigorously in its earlier stages of development. Growing points of the young shoots and of the stolons proved especially susceptible to attack."

__________ Pathogenicity of *Corticium vagum* on the potato as affected by soil temperature. Jour. Agr. Res. 21: 459-482, pl. 88-93. 1921.

> "There is no critical temperature for the pathogenicity of Rhizoctonia, as marked injury to sprouts occurred from 18° C. down to 12°. Above 21° this form of injury is slight and above 24° it disappears. Sprouting of tubers is most rapid about 24°; injury to sprouts by Rhizoctonia is in part dependent on cool temperature and slow growth rate during sprouting."

Shapovalov, Michael. *Rhizoctonia solani* as a potato-tuber rot fungus. Phytopath. 12: 334-336. July 1922. (August)

Common scab caused by Actinomyces scabies (Thax.) Güssow

Common scab, being caused by a soil organism is, as one would suppose, widespread and in many cases destructive. There was, however, no uniformity in the reports regarding it. The date of earliest appearance varied from May to the last of September; its prevalence compared with last year was much less in some states and much more in others, and the losses in individual cases ranged from nothing to one hundred percent.

Table 14. Comparative prevalence of scab and losses incurred in 1922.

State	Prevalence compared with:		% loss	State	Prevalence compared with:		% loss
	Last Year	Average Year			Last Year	Average Year	
Vermont	Less	Less	1-3	Arkansas	Less	Same	1
Massachusetts	Same	-		Ohio	Same	Same	
Connecticut	Same	-		Indiana	-	Same	
New York	Same	-	3	Illinois	Same	Same	t
New Jersey	Less	Same	5	Wisconsin	Less	Same	5
Delaware	Same	Same	.5	Minnesota	Same	Same	0.5
Maryland	More	More	3	Iowa	-	Less	
Virginia	More	-		North Dakota	-	Common	
West Virginia	Unimportant		t	South Dakota	-	More	5-10
Kentucky	More	More	-	Kansas	Same	Same	2
South Carolina	Unimportant		1	Idaho	-	Same	1
Georgia	-	Same		Colorado	Present	-	
Mississippi	-	Less		Arizona	Present		2
Texas	-	-	1				

Mississippi: Scab does not appear to be so widespread as in former years, and although but few growers treat seed potatoes for scab, the less frequent occurrence of the disease is partly attributed to the use of good seed in many parts of the state. Scattering reports have been received as to the disease being present, but damage is very slight. (Neal)

Indiana: Much soil infestation. Believe "russet scab" result of common scab infection (on Rurals). Evidence that organism persists six to seven years in soil obtained in Floyd and Allen Counties. (Gardner)

Minnesota: Very heavy infection reported from Koochiching and Anoka Counties. Light infection from Beltrami. None in Red River Valley. (Section of Plant Pathology)

North Dakota: General. Especially pronounced on heavy soils of Red River Valley. (Weniger)

Kansas: Not of much importance unless tubers are harvested late. (Stokdyk)

There is a general opinion that Green Mountain and Cobblers are more susceptible than other varieties such as the American Giant and the Rural Russets.

(The American Giants in New York are usually resistant, but occasionally are badly scabbed. No cause has been assigned for the unexpected susceptibility - Chupp.)

> "Certain German varieties are reported to possess so high a degree of scab resistance that they may safely be grown in neutral or alkaline soils." (Summary. Potato Association of America. Boston Meeting, 1922)

Wisconsin: Higher on Green Mountain and early varieties. (Vaughan)

New Jersey: American Giant variety less susceptible to scab than Irish Cobbler or Green Mountain. (W. H. Martin)

Control

In addition to the lack of uniformity in nearly every other part of the reports, the sections dealing with control were fully as conspicuous in their disagreement. Sulfur was used in a number of states with variable results. It must be borne in mind, however, that each demonstration differed from the others in type of soil, amount of rainfall, temperature, length of rotation, and other factors which possibly would alter conclusions.

> "The relation between soil reaction and development of common scab has been found to hold for a number of localities and conditions and control of scab by rendering the soil acid is becoming a regular practice in some potato sections. The use of sulfur, either plain or inoculated, is the most general method of increasing soil acidity, but other methods, as the use of fertilizer salts, either normally acid in reaction or acidulated with sulfuric acid, is being successfully tried."
> (Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston Meeting. 1922)

New York: (Nassau County) One potato scab demonstration, where sulphur was used as control, was completed. This demonstration was carefully arranged and exact data taken.

Inoculated Sulphur Plot (Texas Gulf)	Special inoculated
40.20% Clean	34.49% Clean
46.23% Salable	36.77% Salable
13.57% Unsalable	28.84% Unsalable
Check	Plain sulphur
24.42% Clean	39.93% Clean
36.10% Salable	39.77% Salable
39.48% Unsalable	23.26% Unsalable

In another sulphur test some potatoes were found to be injured by sulphur. This injury looks a little like scurf. (H. C. Odell, Weekly News Letter New York State Coll. Agr., July 31)

New Jersey: During the past several years tests have been conducted to determine the influence of various sources of nitrogen on the amount of scab. The results of 2 of these tests follow.

	Yield Bushels per A.	Clean Tubers %	Salable Tubers %	Unsalable Tubers %
Check....................	102.3	24.6	54.4	20.9
Nitrate of soda..........	123.2	20.0	62.9	17.1
Sulfate of Ammonia.......	122.5	42.0	50.2	7.8
1/3 Nitrate - 2/3 Sulfate	125.4	46.8	48.4	4.8
2/3 Nitrate - 1/3 Sulfate	136.6	31.4	58.1	10.5
- - - - - -	- - - -	- - - -	- - - -	
Check....................	140.8	15.2	40.8	43.9
All Nitrate of Soda	299.7	4.6	33.4	62.0
All Sulfate of Ammonia...	308.6	42.6	36.4	20.9
1/2 Nitrate - 1/2 Sulfate	340.5	39.4	33.4	27.2
1/3 Nitrate - 2/3 Sulfate	371.9	29.6	45.8	24.5

New Jersey: Results from the use of sulphur very encouraging. In a number of cases an application of 500 lbs. of sulphur on fields which grew very scabby potatoes in 1921 resulted in a clean crop this year. In fertilizer tests where a comparison was made of nitrate of soda and sulphate of ammonia as a source of nitrogen the potatoes on the former plots were scabbed more severely than on the latter. (W. H. Martin, Oct. 28)

Virginia: We made a few preliminary tests of the inoculated sulphur supplied by the Gulf Sulphur Company. In some of our early work there was evidence of partial control of scab but where the sulphur was used heavy there was also evidence of sulphur injury. (T. C. Johnson, July 24)

Kentucky: One grower reports that ten years ago he could not grow a clean crop of potatoes. Formaldehyde soak for 8 years and corrosive sublimate last two years have given practically complete control. (Valleau & Gardner)

Treatment with inoculated sulfur: Through Mr. J. S. Gardner 2100 lbs. of inoculated sulfur was used on second crop potatoes on 17 1/2-acre plots using 150 lbs. and 300 lbs. per acre and a few 1/50 acre plots on which 600 lbs. were used. In no case was there any noticeable difference in the amount of scab in plots treated with 150 and 300 lbs. and the checks. Where 600 lbs. were used there was good control but a reduction of about 20% in yield. One trial of 600 lbs. was on a farm which was a cavalry barracks during the war. Quick lime was added in large amounts to the manure and as consequence potatoes were too scabby to dig. Six hundred pounds per acre increased the percent of marketable tubers by about ten times with a yield reduction of about 20%. It was very noticeable that in parts of a hill where sulfur could not be seen at digging time no control was obtained, while wherever sulfur was evident good control resulted.

Another trial of 400 lbs. gave no control, while 600 lbs. gave control but appreciably reduced the yield.

In another case 300 lbs. of uninoculated sulfur put on first crop gave no control in either the first or second crop.

In all cases sulfur was put on with a grain drill about two weeks before planting.

300 lbs. of uninoculated superfine sulfur was tried in two cases. It gave no different results from inoculated sulfur.

In one case where 150 lbs. and 300 lbs. per acre inoculated sulfur was put on two weeks before fall crop was planted the potatoes were so scabby that none were dug. (Gardner)

Treating seed potatoes at digging time: Because of the difficulty of drying treated seed potatoes at cutting time in the winter tests were carried on to determine the possibility of treating at digging time and drying and then keeping in the usual manner. Last year three men treated their seed in the fall before storing and this year ten men in Jefferson County have tried it. So far no injury has resulted to the tubers so treated. There is some evidence that this method of treatment will stop Fusarium dry rot which has already become well established on the surface layer of the potatoes. At present the rotted areas may be lifted out with the point of a knife and the tissue immediately below seems healthy. If this is the case it may be a factor in reducing soil infection as this disease appears more troublesome this year where the same disease appeared last year. (Valleau & Gardner)

Treating stored cut seed in the summer: One grower has practiced treating cut seed in the summer before planting. If the seed has been cut sufficiently long before treating so that callous has formed, no injury results. (Gardner)

References

Benham, L. M. Strains and scab control. Rep. Connecticut Veg. Growers Assoc. 1921: 20-25. 1922.

Martin, W. H. Potato fertilizers bear relation to scab. Source of nitrogen may influence amount of scab. Hints to potato growers. New Jersey Potato Assoc. 3⁷: 1922.

__________ Potato scab and methods for its control. New Jersey Agr. Exp. Sta. Circ. 131: 3-12. 1922.

__________ Seed treatment for the control of potato scab. Ann. Rept. New Jersey Agr. Exp. Sta. 41: 587-590. 1921.

Scabby seed treated with bichloride or formaldehyde gave better stand and yield than untreated scabby seed. Dipping for 15 minutes in bichloride, or 30 minutes with formaldehyde gave the greatest yield of salable tubers, but longer treatments gave better control of scab. (Abst. Rept. Res. Comm. Potato Assoc. Amer. Boston meeting 1922)

Millard, W. A. Common scab of potatoes, I. Ann. Appl. Biol. 9: 156-164. June 1922.

Jones, L. R., H. H. McKinney, and H. Fellows. The influence of soil temperature on potato scab. Wisconsin Agr. Exp. Sta. Res. Bul. 53: 1-35. 5 pl. 1922.

Development of potato scab is influenced by several environmental factors, temperature of the soil, among others. Potatoes grown in Wisconsin soil temperature tanks developed scab at all temperatures from 11 to 30°. As measured by number of scabby tubers, 23° seemed to be the optimum for scab development, or about 20° if proportion of tuber surface scabbed be made the criterion. Observations in the field show that scab is more prevalent in regions having high growing season temperatures, and is greater in hot than in cool summers. The mean soil temperature for July and August in the leading Wisconsin

potato districts approximate the optimum for scab development found in the controlled soil temperature experiments. The influence of soil temperature upon scab development seems to be exerted through the effect on tuber development. (Abst. Rept. Res. Comm. Potato Assoc. Amer. Boston meeting. 1922)

Olsen, G. A. Agricultural gypsum as a preventive of potato scab. Potato Mag. 4^{7}: 5-6. Feb. 1922. Also 5^{3}: 7, 23. 1922.

Four years of study at the Rhode Island Experiment Station show clearly that agricultural gypsum is effective in preventing the development of scab; it has also been found satisfactory at the Connecticut Station on heavy types of soil.

Waksman, Selman. The influence of soil reaction upon the growth of actinomycetes causing potato scab. Soil Sci. 14: 61-79. July 1922.

Blackleg caused by Bacillus phytophthorus Appel

The season of 1922 must have been exceptionally favorable for blackleg of potatoes, for collaborators in many states report the disease as more prevalent than usual.

Table 15. Estimated percentage loss due to blackleg in 1922. (Collaborators' estimates)

State	% loss	State	% loss	State	% loss
Vermont	1-	Virginia	2	South Dakota	Trace
Connecticut	.5	Tennessee	1	Kansas	3
New York	Trace	Indiana	Trace	Utah	2.5
Pennsylvania	2	Wisconsin	"	Idaho	.5
Maryland	1	Minnesota	2	Washington	Trace
West Virginia	Trace	North Dak.	3		

Apparently the low temperature in July coupled with the heavy precipitation of either June or July was responsible for the increase. In Oregon, where the damage was said to be much less than usual in 1922, there was hardly any rain for two months after planting time. The high temperature and slight precipitation of July in 1921 may in like manner have reduced the severity of the disease in that year. Figures taken from the U. S. Department of Agriculture Monthly Weather Review 49: 1921 and 50: 1922 are interesting to study in connection with this possibility.

Table 16. Departure from normal temperatures and precipitations in 1921 and 1922.

States where 1% or more of blackleg was reported in 1922	Departure from the normal temperature (°F)				Departure from the normal precipitation			
	1922		1921		1922		1921	
	June	July	June	July	June	July	June	July
Vermont	+2.5	-0.7	-	-	+4.95	-0.29	-	-
Pennsylvania	+1.9	-0.2	+2.7	+3.9	+0.91	-0.53	-1.18	-0.03

States where 1% or more of blackleg was reported in 1922	Departure from the normal temperature (F)				the normal precipitation			
	1922		1921		1922		1921	
	June	July	June	July	June	July	June	July
Maryland	+2.7	-0.4	+2.2	+2.6	+1.10	+1.37	-1.54	-0.23
Minnesota	+2.6	-1.7	+6.2	+5.1	-1.00	-1.40	-1.27	0.00
North Dakota	+0.7	-1.9	+5.5	+3.9	+0.26	-0.21	+0.55	+0.43
Kansas	+2.3	-1.1	+1.6	+1.1	-1.87	+1.49	+0.81	-0.37
States where less blackleg than usual was present in 1922								
Ohio	+1.5	-0.9	+4.2	+4.2	+0.26	-0.21	-0.93	-1.03
Indiana	+1.4	-1.1	+4.7	+5.1	-1.91	+0.04	-0.33	-1.27
Idaho	+4.0	+1.1	+2.3	+0.6	-0.34	-0.26	-0.40	-0.43

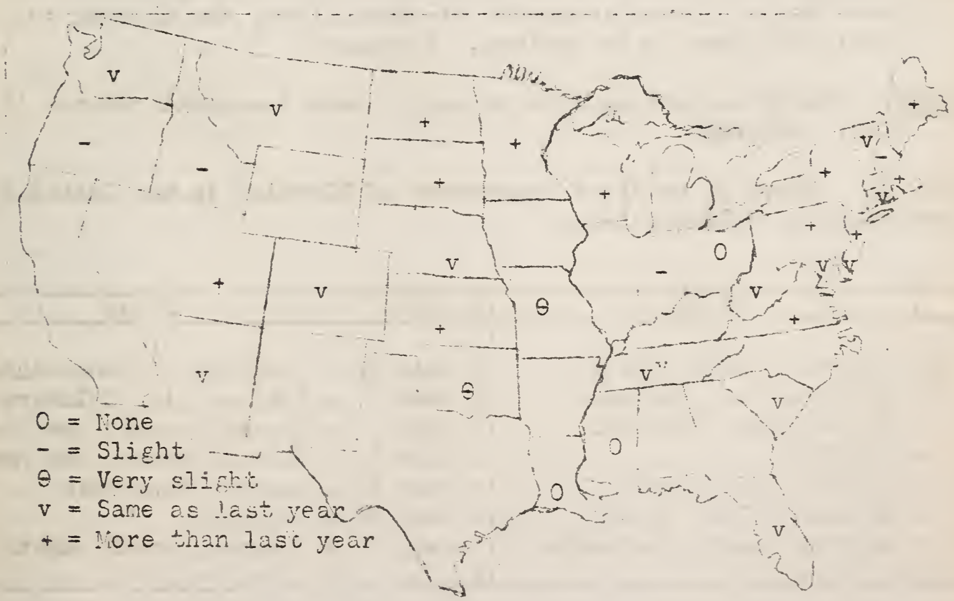


Fig. 3. Distribution of black leg in 1922, according to collaborators.

The introduction of infected seed tubers was the cause of much of the loss. This point was mentioned in many of the reports. In addition to the quotations given below the reader is referred to Plant Disease Bulletin 6: 19, 57, 80, 89, 90, and 111. 1922:

Connecticut: Not usually serious. A plant here and there in the field killed. (Clinton)

New York: Observed in ten counties this year. Where seed treatment is practiced there is never any trouble with this disease. (Chupp)

New Jersey: Present in some sections of the state. In one field in Monmouth County 5% of the plants infected. On the late crop in South Jersey blackleg was observed for the first time. (W. H. Martin, Oct. 28)

Virginia: Blackleg was more prevalent than it has been for a number of years. In some fields the loss from this source alone was fully 10% while in other fields it was not over .5%. (T. C. Johnson, July 24)

Wisconsin: In Early Ohio variety. Seed selection and treatment reducing amount. (Vaughan)

Minnesota: (Northwestern part) Very abundant, especially in Clay County. Many fields with as high as 50% of the plants infected observed in Clay County. Less prevalent further north and east. Numerous contrasts between treated and untreated fields. In general blackleg was more prevalent in the Red River Valley than elsewhere and in general more prevalent this year than last. (J. G. Leach, Aug. 3-5)

North Dakota: Last year the disease was fairly severe, present in scattered localities. Through movement of seed tubers, the disease has spread until this year it is serious. (Weniger)

Kansas: Traced to various lots of seed. Seed treatment reduced it materially. (Stokdyk)

Table 17. Dates of earliest appearance of blackleg in the United States in 1922, according to collaborators.

Date	Place	Date	Place
February 22	Federal Point, Florida	June 30	Farmington, Connecticut
May 24	Indianapolis, Indiana	June	Bridgeville, Delaware
May 24	Springfield, Missouri	June	Nassau County, New York
May	Oklahoma	July 7	East Kingston, New Hampshire
June 3	Fishery, Tennessee	July 11	Racine, Wisconsin
June 27	Allentown, New Jersey	July 20	Vermont
June 29	Dakota County, Minnesota	July	Sherman, South Dakota

Control measures are not mentioned often by the collaborators. In Wisconsin and New York where corrosive sublimate was used, as for Rhizoctonia, the injury from blackleg was reduced

Recent literature

Jennison, H. M. Potato blackleg with special reference to the etiological agent. (Abstract). Phytopath. 12: 444. Sept. 1922.

Concludes that the organism should be referred to Bacillus atrosepticus van Hall, and that the names B. phytophthorus Appel, B. solanisaprus Harrison, and B. melanogenes Pethybridge and Murphy should be considered as synonyms.

Mosaic

Mosaic is the most dreaded of all the diseases of potatoes. It is present in nearly every potato growing section, South Dakota being the only state from which reports were received that did not mention this disease. Comments on the severity of mosaic in the various states may be found in the Plant Disease Bulletin 6: 80, 81, 90, 91, 111, 150, 1922. According to the percentages submitted no disease causes such severe losses as does mosaic. Collaborators report the following percentages for their respective states: Maine (high percentage), New Hampshire 5%, Vermont 10%, Massachusetts 10%, Connecticut .5%, Pennsylvania 3.5%, New Jersey .5%, Maryland 2%, Virginia 1%, Kentucky 4% spring crop - 15% fall crop, Tennessee 3%, South Carolina trace, Mississippi 10%, Louisiana 25%, Texas trace, Arkansas 10%, Ohio, Indiana .5%, Illinois trace, Wisconsin trace, Minnesota 1%, Missouri 5%, North Dakota trace, Kansas .5%, Utah 7%, Arizona trace, and Idaho 10%.

The following states reported more than last year: New Hampshire, Vermont, New York, Wisconsin, North Dakota, South Dakota, Kansas, Utah, Idaho, and Washington. In reality there may not have been a larger percentage of disease present, but the season was such that the symptoms were not masked. This, at least, holds true for New York State, and is in agreement with the findings of the following investigators:

> Symptoms in potatoes appeared at the lowest temperature tested, 6° C., were best between 14° and 18° C., and disappeared above 20° C. Ten days at 36° C. did not kill the virus. (James Johnson (1)) (Abst. from Rept. Res. Comm. Potato Assoc. Amer. Boston meeting 1922.
>
> "...... Observations (1919-1922) indicate that low humidities, high temperatures, and intense sunlight which characterize the growing seasons of the semi-arid and arid west cause not only such pronounced masking of mosaic and other virus disease symptoms, but also such marked changes in healthy plants that the symptomatology determined in the humid sections and the methods of field inspection used there are inadequate in the west. This is especially true under dry-land conditions." (Geo. K. K. Link (2))
>
> "In the Rocky Mountain and other western potato growing sections the mosaic disease of potatoes has seldom appeared conspicuously in the generally characterized form. Some factor or set of factors masks the symptom of mottling............ It is believed that the large amount of short wave-length light in the sunlight at high altitudes stimulates chlorophyll production in mosaic diseased cells, the effect being to mask the common symptoms. Some antiseptic action is possible. The life of the mosaic plants is longer under these circumstances. Non-mottled mosaic plants transferred from high to low altitudes readily develop mottling." (H. G. MacMillan (3))

A tremendous amount of work has been done on mosaic diseases in general, and particularly on potato mosaic. Not the least interesting is that which deals with transmission of the disease to various hosts. (See "References" of Melhus (10), Elmer (6), Fernow (7), and Doolittle and Walker (5). A new field has been opened in the investigations on the cause of mosaic diseases. Space is not permitted here to discuss this interesting topic, but the articles by Smith (13), Kunkel (8), Nelson (11), McKinney (9), and Palm (14) (See "References") are sure to bring forth much worth while discussion and research.

It has been proved repeatedly that aphids transmit the infective principle from diseased to healthy plants. The question is raised by Miss Patch (2) whether among the twenty-one other species of sucking insects parasitic on potatoes, one or more may not function in a similar manner. Mosaic, according to observation in New York, spreads when no aphids can be found. (Mosaic was disseminated rapidly in the fields, even though no aphids could be found in many places - Chupp) Another important phase is the possible overwintering of the causal factor in perennial plants. This has been proved for tomato mosaic, and now Melhus (10) shows that Physalis longifolia carries a mosaic which is transmissible to potato.

Table 18. Dates of earliest appearance of mosaic in 1922.

Date	Place	Date	Place
March	Baton Rouge, Louisiana	June 17	Shawnee, Kansas
May 17	Indiana	June 25	Vermont
May 30	New Brunswick, New Jersey	June 30	Farmington, Connecticut
May	Hattiesburg, Mississippi	June	Nassau County, New York
June 3	Ramsey County, Iowa	June	Fayetteville, Arkansas
June 12	New Castle County, Delaware	July 1	Kingston, New Hampshire
June 15	Sturgeon Bay, Wisconsin		

Unlike many of the common potato diseases, mosaic attacks certain varieties severely and others only slightly. The degree of susceptibility or resistance of any one variety seems to be uniform throughout the country, as is shown by the following reports:

New York: More common on Green Mountain type than on smooth or russet rurals. (Chupp)

New Jersey: More abundant on Green Mountains and American Giant varieties than on the Irish Cobbler. (W. H. Martin)
Maryland: McCormick very susceptible. (Temple & Jehle)
Mississippi: Bliss Triumph continues to be very susceptible. We are urging our growers to try certified northern grown stock, especially the Wisconsin "Smith" strain and some Nebraskan strains. (D. C. Neal)

Indiana: Not prevalent in late Rurals. (Gardner)

Wisconsin: Major on Triumph; considerable on Green Mountain. (Vaughan)

Missouri: Noted on Early Ohio, Cobbler slightly. Most severe on Triumph. (W. E. Maneval)

Idaho: Evidently different types of mosaic. Idaho Rural more susceptible than Netted Gem. (Hungerford)

Wisconsin: Most ever seen. Some plantings of unselected Triumph stock show 100% infected plants. Even the Smith strain shows 2% on the Spooner Branch Station. (Vaughan)

Control Measures

In the states where potato seed growing is not possible the growers are quite generally beginning to use northern certified seed, and evidently with gratifying success, according to the following reports from collaborators.

New York: (Nassau County) Mosaic in certified seed test plots averaged about 1%, while in common seed the average was about 14%. The ordinary common seed showed much more mosaic than here mentioned. Many fields run nearly 50%. (H. C. Odell, Weekly News Letter, July 10)

Arkansas: Best results are from locally selected mosaic-free plants. (Elliott)

Louisiana: Had excellent success with certified seed this season. (Edgerton)

Northern growers are planting the best seed obtainable and attempting to keep down the percentage of loss by roguing the diseased hills. It is not always possible to obtain seed tubers sufficiently free from mosaic to justify roguing. The source of clean Green Mountain seed is limited, thus making it necessary to scout for isolated disease-free seed, or in some way grow healthy stock from that which has been diseased. The latter alternative has been made possible by the work which Blodgett, Fernow and Perry (4) have done on tuber indexing. It has been demonstrated that large enough quantities of seed tubers can be indexed to plant an isolated seed plot, and a number of clean strains have already been started by this method in New York.

Recent literature

(Cited)

1. Johnson, James. The relation of air temperature to the mosaic disease of potatoes and other plants. Phytopath. 12: 438-440. 1922.
2. Link, Geo. K. K. Mosaic and leafroll of the potato in the Northwest. (Abstract) Phytopath. 13: 39. 1923.
3. MacMillan, H. G. Potato mosaic masking at high altitudes. (Abstract) Phytopath. 13: 39. 1923.
4. Blodgett, F. M., Karl Fernow, and F. R. Perry. Testing seed potatoes for mosaic and leafroll--II. (Abstract) Phytopath. 12: 40. 1922.
5. Doolittle, S. P. and M. N. Walker. Notes on cucurbit mosaic. (Abstract) Phytopath. 12: 42. 1922.
6. Elmer, O. H. Mosaic cross-inoculation and insect transmission studies. Science n.s. 56^{1448}: 370-372. 1922.
7. Fernow, Karl H. A new host for potato mosaic. Phytopath. 13: 40-41. 1923.
   "Twelve plants of the Apple of Peru, Nicandra physaloides, which were rubbed with crushed leaves of mosaic potato plants all developed distinct mottling. Four plants rubbed with leaves of mosaic tomato, four with leaves of mosaic tobacco, two with leaves from a mottled burdock plant and two with their own healthy leaves remained healthy."
8. Kunkel, L. O. A possible causative agent for the mosaic disease of corn. Bul. Exp. Sta. Hawaiian Sugar Plant. Assoc. 3^{1}. 1921.
9. McKinney, H. H., Sophia H. Eckerson and R. W. Webb. Intracellular bodies associated with the rosette disease of wheat. Phytopath. 13: 41. 1923.
10. Melhus, I. E. Mosaic studies. (Abstract) Phytopath. 12: 42. 1922.
11. Nelson, Ray. The occurrence of protozoa in plants affected with mosaic and related diseases. (Abstract) Phytopath. 13: 41. 1923. (Complete

paper in Michigan Agr. Exp. Techn. Sta. Bul. 58. 30 p. Dec. 1922)

12. Patch. E. M. Aroostook potato insects. Jour.Econ.Entom.15: 372-373. 1922.

    Twenty-one species, besides aphids are listed as sucking insects possibly transmitting degeneration diseases inasmuch as they feed on potatoes and have not been tested. (Abst. from Rept. Res. Comm. Potato Assoc. Amer. Boston meeting 1922)

13. Smith, K. M. Mosaic disease in plants. Nature 110: 668. Nov. 18, 1922. (Discovery in tissue of potato plants affected with mosaic of bodies apparently similar to those discovered by L. O. Kunkel in maize.)

14. Palm, B. T. Is the mosaic disease of tobacco a Chlamydozoonose? Bul. Deliproefet. Medan-Sumatra 15: 1-10. 1922.

(Not Cited)

Blodgett, F. M. The relation of time and temperature to killing of potatoes and potato mosaic virus. (Abstract) Phytopath. 12: 40. 1922.

"From 35° to 80°, the time necessary to kill the virus is longer than that necessary to kill the tuber."

Coons, G. H. and J. E. Kotila. Mosaic in potato seed stock. Quart. Bul. Mich. Agr. Exp. Sta. 4: 135-138. May 1922.

Cotton, A. D. The situation with regard to leaf curl and mosaic in Britain. Rep. Internat. Potato Conf. 1921: 153-168. 1922.

Cuthbertson, William. Lessons for practical men from the International Potato Conference. Fruit Grow. Fruiterer Flor. & Mark. Grow. 54: 59-60. July 13, 1922.

Dickson, E. T. and E. G. Hood. Temperature studies in mosaic diseases. (Abstract) Phytopath. 13: 42. 1923.

Dubois, P. La lutte contre la "dégénérescence" des pommes de terre dans l'ouest de la France. Rev. Bot. Appl. 2: 586-589. October 1922.

________ Maladies de dégénérescence de la pomme de terre. La Vie Agricole & Rurale 20: 187. March 18, 1922.

McKinney, H. H., Sophia H. Eckerson, and R. W. Webb. Intracellular bodies associated with a "mosaic" of Hippeastrum johnsonii. Phytopath. 13: 41-42. 1923.

Murphy, Paul A. Some recent work on leafroll and mosaic. Rept. Internat. Potato Conference. Roy. Hort. Soc.; London, 1921: 145-152. 1922. (Abstract in Bot. Absts. 11: entry 2920. 1922)

Orton, W. A. New work on potato diseases in America. Rept. Internat. Potato Conference. Roy. Hort. Soc.; London, 1921: 169-179. 1922.

Patch, E. M. Rose bushes in relation to potato culture. Maine Agr. Exp. Sta. Bul. 303: 321-344. Dec. 1921.

Quanjer, H. M., J. C. Dorst, M. D. Dijt, and A. W. v. d. Haar. De mozaiekziekte van de solanaceeën hare verwantschap met de phloeemnecrose en hare beteeknis voor de aardappelcultuur. Meded. Landbouwhoogesch. Wageningen 17: 1-74. 1919.

English summary (The mosaic disease of the Solanaceae, its relation to phloem-necrosis and its effect on potato culture): p. 71-74.

Leafroll

Leafroll is evidently not so general in its distribution as is mosaic. This may be the result of soil and climate, either repressing the disease or masking the symptoms, or it may be due to resistant varieties grown in a given locality. For instance, in South Carolina and Mississippi the disease is unimportant or absent. The same holds true for Wisconsin, Minnesota, South Dakota, Kansas and Washington. On the other hand, the trouble is very pronounced in New England, New York, Pennsylvania, New Jersey, Delaware, Kentucky, Ohio, Michigan and Indiana. Idaho includes another area where the disease is doing much damage. Following are the recorded percentages:

30 - Kentucky
15 - Pennsylvania
7 - Ohio
5 - New Hampshire, Massachusetts, New York, Indiana
3 - Idaho
2.5 - Vermont
2 - Maryland, Virginia
1.5 - New Jersey
1 - Delaware

The above percentages with a few additional notes by collaborators will give an idea of the great losses incurred through leafroll.

New York: (Onondaga County) Further examination of potato fields justifies the earlier indication that such diseases as leafroll will be much more in evidence than last year. Leafroll in potato fields which were practically free last year is showing from 10% to 20%. (D. D. Ward, July 17)

(Monroe County) Leafroll is serious in many fields going as high as 50% in some. (A. L. Pierstorff, July 24)

New Jersey: Very prevalent throughout the state. Some fields observed showing as much as 85%. Especially severe in the Irish Cobbler variety. On late crop grown for seed, leafroll principal cause for disqualification of seed entered for certification. The last week of September a rolling of the top leaves of Irish Cobblers became common, probably the result of a late infection by leafroll. (W. H. Martin)

Kentucky: Seems to spread much more rapidly than mosaic. Stock practically free in 1921 show 95% infection in fall of 1922 when planted. Spindle sprout tubers selected last winter were without any net necrosis in spring but produced leafroll plants. Tubers from them small but do not show net necrosis. Some other tubers in same lot last winter had spindle sprout and net necrosis.

Spindle sprout is very common in leafroll stock in Kentucky. Spindle sprout tubers usually send up one weak stalk which branches only slightly. If branches are developed they are usually much longer than the central stalk. (Valleau)

New Jersey: Tests conducted with leafroll and healthy plants over a period of two years show a reduction of 95.3 bushels in yield as the result of the presence of the disease. Especially severe on Irish Cobblers.

Effect of leafroll on yield

Condition of plants	Height of vine cm.	Yield per acre,-bu.
Lower leaves pronounced roll - Fall 1921	36	146

		Height of vine cm.	Yield per acre Bu.
Medium leaves considerable roll,	Spring1922	47	138
Top leaves small,	Fall 1922	-	126
Lower leaves normal	Fall 1921	50	201
Medium leaves normal	Spring 1922	59	191
Top leaves normal	Fall 1922	-	221

(W. H. Martin)

Manitoba, Canada: Rather serious. The use of certified seed is relieving the situation somewhat. (G. R. Bisby)

As in the case of mosaic, there now have been reported three types of leafroll, the common leafroll, giant hills and spindling tubers or marginal leafroll. According to Quanjer (2) marginal leafroll, which involves only the borders, is not so common as the true leafroll; there is no phloem necrosis and starch transport is very little disturbed, and it has not been determined whether it is infectious

Fernow (1) and Schultz and Folsom (3) give descriptions of spindling tuber, which are quoted below. (See under other degeneration diseases.)

The statements made about etiology, dissemination and control of mosaic apply equally well to leafroll. In the matter of varietal susceptibility, however, the conditions are reversed. Those varieties which are most susceptible to mosaic are usually more resistant to leafroll, although there is probably no variety which is immune.

Massachusetts: Most often recognized on Irish Cobbler. (Osmun)

New York: More common on the smooth and Russet Rurals. (Chupp)

New Jersey: Especially severe on Irish Cobblers. (W. H. Martin)

Idaho: More in northern Idaho in non-irrigated section. Netted Gem potatoes evidently more susceptible than Idaho. Rurals. (Hungerford)

The control measures are the same as those for mosaic. Indexing and roguing are both practiced. According to Chupp, in New York, careful roguing and isolated seed plots will almost entirely eliminate leafroll. He says it is easier to cope with this disease than with mosaic. Gardner in Indiana says:

> "Field tests with tubers indexed by greenhouse tests showed marked reduction in yield due to leafroll."

References (Note: See also references under mosaic)

(Cited)

1. Fernow, Karl H. Spindling tuber or marginal leafroll. Phytopath. 13: 40. January 1923.
2. Quanjer, H. M. New work on leaf-curl and allied diseases in Holland. Rept. Internat. Potato Conf. Roy. Hort. Soc.: London, 1921: 127-145. 1922.

3. Schultz, E. S. and Donald Folsom. Spindling-tuber and other degeneration diseases of Irish potatoes. (Abstract) Phytopath. 13: 40. Jan. 1923.

(Not cited)

Artschwager, Ernst. Occurrence of phloem necrosis in leafroll tubers. Phytopath. 12: 193-194. April 1922.

Bisby, G. R. Curl in potatoes. Gard. Chron. III, 71: 128-129. March 1922.

Blodgett, F. M. Hot water and hot air treatments of potatoes. (Abstract) Phytopath. 13: 55. Jan. 1923.

Cotton, A. D. Potato leaf curl demonstrations. Jour. Min. Agr. Gt. Brit. 28: 1019-1021. Feb. 1922.

Foëx, Etienne. Enroulement et leptonécrose. Bul. Soc. Path. Vég. France 8: 148-149. Feb. 1922.

Gilbert, Alfred H. The correlation of foliage-degeneration of diseases of the Irish potato with variations of the tuber and sprout. (Abstract) Phytopath. 12: 40. 1922.

Hungerford, C. W. Leafroll, mosaic and certain other related diseases in Idaho. Phytopath. 12: 133-139. March 1922. (Russet dwarf is mentioned)

Kasai, Mikio. Observations and experiments on the leafroll disease of the Irish potato in Japan. Ber. Ohara Inst. Landw. Forsch 2: 47-77. 1921.

Link, George K. K. Mosaic and leafroll of the potato in the Northwest. (Abstract) Phytopath. 13: 39. Jan. 1923.

Martin, W. H. "Spindle tuber," a new potato trouble. Hints to potato growers. New Jersey State Potato Assoc. 3: 1-4. 1922. (Symptoms are described in detail, the disease is discussed, and reduction in yields given.)

Tipburn (non-parasitic) and hopperburn induced by leaf hoppers (Empoasca mali)

> "There appear to be at least two types of tipburn; one is specific and may be produced artificially by allowing potato leaf hoppers to feed on the plants, or by injecting extracts of nymphs or adults of this species. Juice from such plants may be used to infect other plants. Sunlight is not a factor in the development of this tipburn.
>
> "Another type of tipburn occurs in the field in the absence of leaf hoppers and may be produced experimentally by subjecting the plants to intense illumination under dry conditions. This is believed by Lutman to result from excessive water loss from the leaves principally through the water pores at the leaf margin and apex. Direct destruction of chlorophyll and plasmolysis of the mesophyll cells are accessory effects." (Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston meeting. 1922)

Some of the collaborators in their reports differentiated between tipburn and hopperburn, while others did not. It seems advisable therefore to treat them under the same heading.

The amount of tipburn and hopperburn prevalent was comparable with last year and the average year. In some states it was much more severe, while in others it was less.

Table 19. Prevalence and importance of tipburn and hopperburn in the United States in 1922, according to collaborators.

State	% loss	State	% loss	State	% loss
Vermont	1-3	West Virginia	20	Indiana	5
Massachusetts	Trace	Kentucky (spring crop)	4	Illinois	3
Connecticut	10	South Carolina	1	Michigan	Destructive
New York	5	Louisiana	2	Wisconsin	5
Pennsylvania	4	Mississippi	1	Minnesota	6
New Jersey	1	Texas	Present	Iowa	15
Delaware	4.5	Arkansas	3	Missouri	10
Maryland	1	Oklahoma	Considerable	South Dakota	10
Virginia	1	Ohio	12	Kansas	Considerable
				Idaho	Unimportant

The three following reports are given by collaborators:

Connecticut: After field died, hard to tell from the late blight without microscopic examination. (Clinton)

New York: Less common in St. Lawrence Valley, and on high altitudes in other parts of the state. Although rainfall was plentiful, tipburn and hopperburn were plentiful. Careful spraying reduces the loss. (Chupp)

New Jersey: Most of the tipburn observed on both the early and late crop is believed to be due to leaf hoppers. In South Jersey the Irish Cobbler vines were found to be covered with leaf hoppers. The injury was first observed July 1st. Leaf hoppers were found as late as October 10 on the late crop and were responsible for the early dying of unsprayed fields. (W. H. Martin, Oct. 28)

Table 20. Dates of earliest appearance of tipburn in the United States in 1922, according to collaborators.

Date	Place	Date	Place
April	Louisiana	June	Hayti, South Dakota
May 16	Agricultural College, Mississippi	July 1	Salem County, New Jersey
May	Oklahoma	July 10	Vermont
June 3	Hennepin County, Minnesota	July 29	Canaan, Connecticut
June 16	New Castle, Delaware	Aug. 2	Columbiana, Ohio
June 28	Rhinelander, Wisconsin		

Weather conditions were an all-important factor in the production of tipburn, but did not influence the damage done by leaf hoppers.

New York: In spite of one of the coolest, wettest seasons experienced in years, this section is experiencing almost a scourge of leaf hoppers. Early and medium early planted potatoes are severely affected. (C. R. Stevenson, August 28)

Wisconsin: Correlated with dry weather. Very little damage where there was plenty of rain. (Vaughan)

Minnesota: During hot period, June 1-3, tipburn abundant, leaf hoppers absent, checked by rain; later cases confused with hopperburn. (Section of Plant Pathology)

Missouri: Very hot, dry June seemed to make conditions more favorable for trouble. Late crop also affected with hoppers abundant. Data by E. M. Page. (W. E. Maneval)

Very few comments have been received regarding varietal susceptibility. From all indications the most resistant varieties are susceptible enough to suffer great injury in areas where the weather is hot enough to produce tipburn, or the leaf hoppers are plentiful enough to cause damage.

New York: In most sections the Rural Russet potato is least affected. (Chupp)

Minnesota: Triumph and Early Ohio are very susceptible. (Section of Plant Pathology)

Control measures:

Spraying as a control measure was uniformly successful, as will be seen by the following reports:

New Jersey: A spraying experiment conducted in South Jersey gave good control of hopperburn. On July 14, plots sprayed three times with Bordeaux mixture showed 2.5% of the leaves dead as compared with 50.3% on the unsprayed checks. (Martin)

In a spraying test at Elmer on first crop Irish Cobblers there was only a trace of early blight but leaf hoppers were present in great numbers. The various plots received four applications of home made Bordeaux mixture (5-5-50). A count of dead leaves on July 14 gave the following results: Check 50%, Sprayed 5.4%. Most of the injury was apparently that caused by the activities of the leaf hoppers. The average yield of the various plots was, Check 162.6 bu. Spray 201.7. (Martin)

Five applications of Bordeaux mixture gave increase of 32.3 bushels, largely due to hopperburn control. (Martin)

West Virginia: Vines killed prematurely. General, but eastern and western sections suffered most severely. 5-5-50 Bordeaux increased yield of marketable potatoes from 50 to 75 per cent. (Giddings)

Ohio: Very prevalent in unsprayed fields, can be controlled with Bordeaux. (Freda Detmers)

Wisconsin: Very well held in check by applications of Bordeaux. (Vaughan)

South Dakota: Very severe this year. Hoppers in great numbers of unsprayed fields. Fields sprayed with Bordeaux remarkably free. (Evans)

> ".....Spraying may result in greatly increased yields where only tipburn and early blight are factors....." (Summary of recent advances in the investigation of parasitic diseases of the potato. Potato Assoc. Amer. Boston meeting. 1922)

References:

Ball, E. D. Insects as disseminators of plant diseases, II. Systematic relations of carriers. Phytopath. 12: 229-231. 1922.

Eyer, John R. Preliminary note on the etiology of potato tipburn. Science n.s. 55: 180-181. Feb. 17, 1922.

> "Tipburn of the potato plant may be produced by the extract made from macerated nymph or adult, Empoasca mali Le B., and is transmissible by direct inoculation. This points to the existence of a 'specific', either normal or extraneous, transmitted by the leaf hopper as the cause of the disease."

——————— Notes on the etiology and specificity of the potato tipburn produced by Empoasca mali Le Baron. Phytopath. 12: 181-184. April 1922.

Fenton, F. A. and I. L. Ressler. Artificial production of tipburn. Science 55: 54. 1922. Jour. Econ. Ent. 15: 288-295. 1922.

> "Injection of emulsions prepared from adult leaf hoppers (Empoasca mali) but not from nymphs produced symptoms of tipburn in potato plants." (Abst. from Rept. Res. Comm. Potato Assoc. Amer. Boston meeting, 1922)

Folsom, Donald and E. S. Schultz. Potato tipburn in northeastern Maine. (Abstract) Phytopath. 12: 36. Jan. 1922.

> Leafhoppers were absent and true tipburn resulted from hot and dry weather conditions as well as certain degeneration diseases.

Leach, J. G. Leaf hopper injury of potatoes. (Abstract) Phytopath. 12: 37. Jan. 1922. (A leafrolling curl disease; not ordinary hopperburn)

Lutman, B. F. Relation of structure of potato leaves to tipburn. Potato Mag. 5^{6}: 22-23. September 1922.

——————— The relation of water pores and stomata of the potato leaf to the early stages and advance of tipburn. Phytopath. 12: 305-333. 15 figs. 1922.

Other Degeneration Diseases

The nomenclature and rather incomplete descriptions of diseases which are either different phases of mosaic or leafroll, or closely related troubles, have become so numerous and so mixed that it is impossible to say which are distinct diseases, and which are merely phases of the same trouble. Following are some of the terms now being used: leaf-rolling mosaic, mosaic dwarf, severe mosaic, mottled mosaic, corrugated mosaic, curly dwarf, mottled curly dwarf, calico, marginal leaf-roll, and spindling tuber, giant hills, crinkle, leaf drop, russet dwarf, streak, stipple-streak, spindle-sprout, and others.

Spindle-sprout, probably caused by poor storage of seed was reported by Clinton of Connecticut. In Idaho the spindle-sprout was usually connected with leafroll.

Spindle-tuber or long-tuber and marginal leafroll were present in Maine, New York, New Jersey and probably other states.

> "Transmission of spindling-tuber disease, commonly designated as 'running-long' or as a type of 'running out,' has been obtained with tuber grafts, vine grafts, leaf-mutilation inoculation, and aphids. Symptoms are erect and spindling stalks, smaller, more erect and somewhat darker green leaves than in healthy foliage, and spindling, spindle-shaped tubers (instead of flat, oblong tubers as in healthy Green Mountains) with more numerous and more conspicuous eyes and with a smoother skin and consistency less firm than in healthy tubers. Spindle-tuber is in the leading commercial varieties in all percentages of incidence; spreads about as readily as mosaic; infects hills in part, resulting in diseased and healthy progeny from the same hill or even from the same tuber, as in mosaic and leafroll; and reduces the yield considerably. In addition to carrying mild mosaic, leafroll, and spindling-tuber, aphids transmit leaf-rolling mosaic, severe mosaic, and unmottled curly-dwarf. Leaf-rolling mosaic forms a curly-dwarf when in combination with spindling-tuber. Severe mosaic is more injurious and infectious, and causes current-season symptoms oftener and sooner than mild mosaic or leafrolling mosaic. If isolated from other degeneration diseases, mild mosaic strains will not acquire different symptoms. Mosaic and leafroll, together, or other degeneration disease combinations, may reduce tuber production affecting self-elimination. Transmission to healthy plants decreases as the distance from diseased plants increases, and fluctuates seasonally and regionally with aphid infestation." (Schultz, E. S. and Donald Folsom. Spindling-tuber and other degeneration diseases of Irish potatoes. Phytopath. 13: 40. 1923)

> "The marginal leaf-roll disease of potatoes was recognized as a disease in 1921, when tuber units showing a large percentage of marginal leaf-roll were seen. The most striking characteristic of the disease is the elongation of the tubers which is often extreme. The vine shows an upright habit and is frequently dwarfed. The leaflets are slightly rolled at the margins, which are often crinkled, and are somewhat smaller than normal but do not show the extreme rolling which occurs in true leaf-roll. The stolons are not shortened as in true leaf-roll and there is no phloem necrosis. The examination for phloem necrosis were made by Dr. Artschwager. The yield is considerably reduced. That the disease is transmissible is shown by the fact that among tuber units having a common ancestry some had degenerated while others were normal. A healthy

> plant on which a diseased scion was grafted produced a typically elongated tuber. The progeny has not been grown. The disease has been observed in Rurals, Green Mountains and Cobblers. The disease was previously mentioned by Quanjer. He noted the absence of phloem necrosis but not the elongation of the tubers." (Fernow, Karl H. Spindling tuber or marginal leaf-roll. Phytopath. 13: 40. 1923)

From observations the indications are that the disease is of a similar nature to mosaic or leafroll, according to Martin in New Jersey, who says:

> "This trouble was first observed in South Jersey on the Irish Cobbler variety in the fall of 1921. The vines of affected plants grow upright, branch but little and are smaller than normal. The leaves are much more narrow and pointed than typical Cobbler leaves. In some cases the margins of the leaves roll in a manner suggesting leafroll. The tubers are long, narrow, smooth skinned, and show more eyes than the true Cobbler.

Table I

Type of seed	Length	Width	Ratio Length to width
Fall 1922:			
Affected Cobblers	7.35	5.20	1.41
Healthy "	6.73	6.19	1.08
Summer 1922:			
Affected "	5.76	4.10	1.40
Healthy "	5.69	5.07	1.10

> "The condition of the vines of the various lots of seed is shown in Table II. (Observation July 17)

Table II

Type of seed	Height cm.	% dead leaves
Affected Cobblers	30.6	57.9
Healthy "	47.2	22.6

> "The yield of the various plots is shown in Table III.

Table III

Type of seed	Primes Bu.	Sec. Bu.	Culls Bu.	Total Yield bu.
Affected Cobblers	10.4	32.0	23.2	65.6
Healthy "	89.6	20.4	10.8	120.8

Streak was present in many fields in New York State. It was more commonly found in fields planted with Maine seed. *Russet-dwarf* - Idaho - Idaho Rurals most susceptible. Disease similar to if not type of mosaic (Hungerford) *Calico* - relatively unimportant in Idaho.

Recent literature on degeneration diseases (see also mosaic, leafroll, and tipburn).

Atanasoff, Dimitar. Stipple-streak disease of potato. Meded. Landbouwhoogesch. Wageningen 24: 1-32. 1922.

________________ A study into the literature on stipple-streak and related diseases of potato. Meded. Landbouwhoogesch. Wageningen 26: 1-52. 1922.

Schultz, E. S. and D. Folsom. A "spindling-tuber disease" of Irish potatoes. Science 57: 149. 1923.

______________________ Transmission of potato streak. (Abstract) Phytopath. 12: 41. Jan. 1922.

Yellow dwarf (causal organism not yet determined)

Yellow dwarf is probably the most menacing of all the newly discovered potato diseases. This season it was found in Vermont, New Jersey, and Pennsylvania, in addition to New York. Disseminated by means of the seed, it has reached every potato county of the last named state. As yet it has caused only minor losses, but there are now enough badly infested fields to show that when the inoculum once gets into the soil, it continues to increase until the field becomes unprofitable for potatoes. Not only is the inoculum carried with the seed and in the soil, but the disease spreads from one plant to another. It was thought at first that the diseased tubers were so evident that naturally they would be discarded at planting time. This idea has proved fallacious, for the seed pieces which produce affected hills, are generally from large, healthy-appearing tubers. These evidently come from plants infected late in the season. No variety has been found which is immune.

New York: Will live in the soil indefinitely. No treatment known. Found in 121 of 373 fields inspected. No great loss yet, but the disease is menacing seed production. (Chupp)
Onondaga County - Considerable yellow dwarf is being found in blue sprout fields, running as high as 10% in some cases. Some yellow dwarf is found on the Green Mountains. (D. D. Ward. N. Y. State Col. Dept. Pl. Path. & Ent. Weekly News Letter, July 24, 1922)
Ulster County - One potato field was found containing yellow dwarf disease. (E. V. Shear. N. Y. State Col. Agr. Dept. Pl. Path. & Ent. Weekly News Letter, July 17, 1922)
Suffolk County - More found this year than last. Vogel.

New Jersey: Yellow dwarf described by Barrus and Chupp found in isolated cases in Monmouth, Mercer and Middlesex Counties. Seed from New York State. (Martin)

Pennsylvania: The only place where we have seen undoubted specimens of yellow dwarf is in Luzerne County. No doubt the disease has occurred elsewhere. (C. R. Orton)

Vermont: Never noted in Vermont before. Observed in several sections including Ira.

References

Barrus, M. F. and Charles Chupp. Yellow dwarf of potatoes. (Abstract) Phytopath. 12: 39. Jan. 1922. Abstract of reference below.

Barrus, M. F. and Charles Chupp. Yellow dwarf of potatoes. Phytopath. 12: 123-132. March 1922. (This disease is described, being prevalent in a number of varieties in New York State. It apparently is seed-perpetuated.)

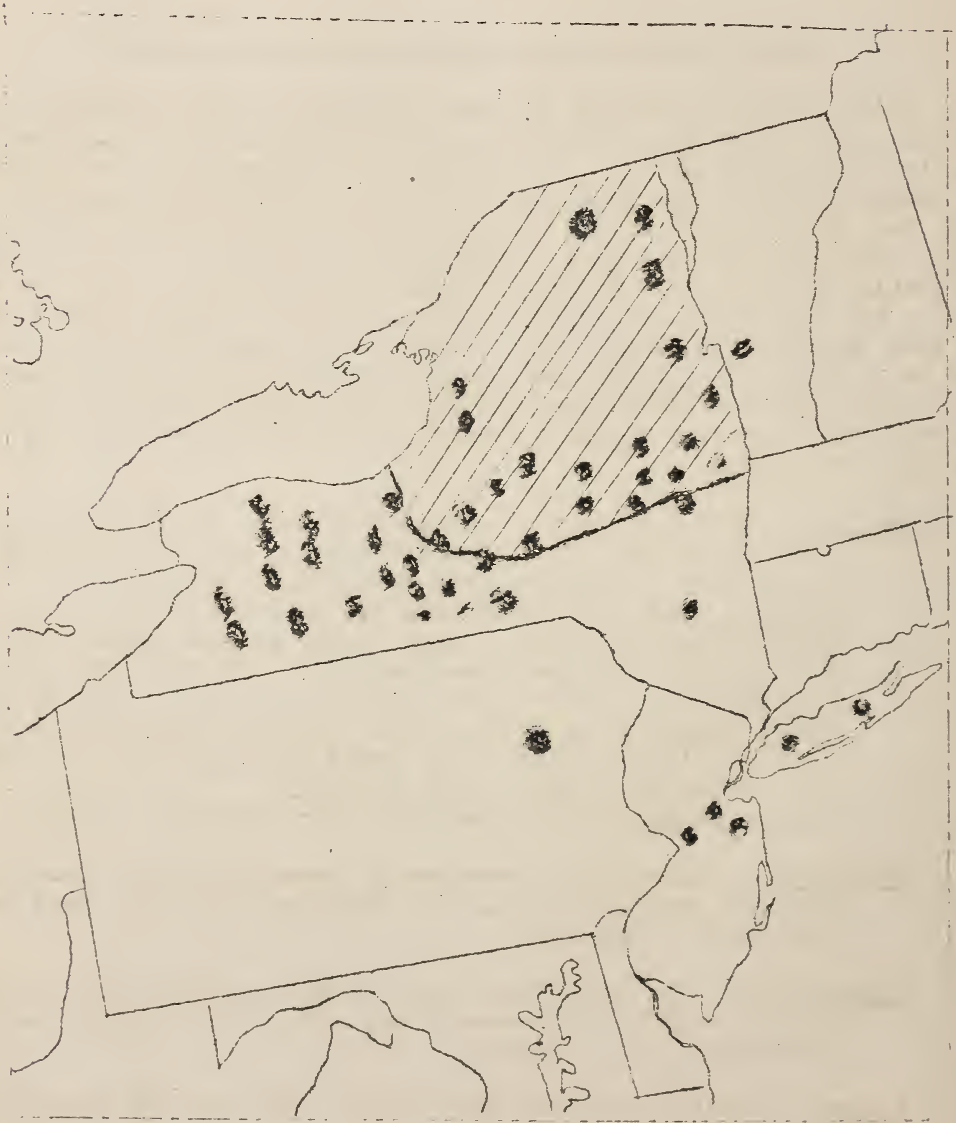


Fig. 4. Known distribution of yellow-dwarf in 1922. Soil infestation seems most abundant in the Mohawk and Champlain Valleys of New York, although there is a rather general infestation in the area represented by the shaded portion.

Poor stands, and decaying seed pieces

In New York 1800 acres of potatoes were inspected in 24 counties and the average number of missing hills was 7.97%. There were many causes for these missing hills, such as planter skips, rhizoctonia, drowning, poor seed etc. Regarding poor stands, T. C. Johnson writes from Virginia:

> "In a general way the Irish potato crop in Eastern Virginia has been somewhat unsatisfactory this year. In the first place, the seed potatoes received from the North were in rather poor condition. Some of them were badly overgrown while others were markedly infected with Rhizoctonia, and some evidences of late blight were also present. These conditions, together with local conditions at the time of planting, caused a very poor germination. However, on the whole I think the germination was better than it was in 1921. The extreme wet weather experienced during the months of January, February, and early part of March necessitated the planting of potatoes when the ground was really too wet. This, together with the disease conditions mentioned, was undoubtedly an important factor in causing poor germination.
>
> "There were very few potatoes treated with formaldehyde before planting. We treated ours at the Norfolk Station and also at the Eastern Shore Station with cold formaldehyde, using 1 pint to 30 gallons of water. This seems to have given us the customary good results. The germination at our Eastern Shore Station in Accomac County was fully up to the average. In some of our fields we had from 95 to 98 per cent of a stand, while in others the stand was from 85 to 95 per cent."

The use of sulphur on cut seed

Valleau and Gardner give the following information regarding the use of flowers of sulfur as a dust on cut seed in Kentucky:

> "It is common practice in the potato growing sections of Kentucky to select seed potatoes in the fall, put them in the cellar until work slackens up in the winter and then cut them and put them in cold storage, for the fall crop. There has been a general impression that northen grown seed stock can not be handled this way. Northern grown potatoes cut in winter rolled in flowers of sulfur and put in cold storage, then shipped half way across the state the next summer, gave 100 per cent stand. The Kentucky stock has been found to come through the summer with much less shrinkage and if dusted with sulfur no growth of the cut surfaces with fungi as is common with undusted pieces. After a few demonstrations the growers in Jefferson County last year bought six tons of sulfur at cutting time. They were so well pleased with the condition of the seed at planting time that the practice will undoubtedly be more widespread this winter. As to field control of diseases, there is some question, but one grower commenced this practice 12 years ago and has used it each year since. At the time his land produced very scabby potatoes. During the last five years

he has had practically no scabby potatoes. In spite of the fact that scab was very prevalent this year, his crop was clean. He believes it is the result of this cumulative effect of the sulfur in gradually reducing the scab present in the soil. This practice seems well worth trying on a large scale where scab is a factor. It will never introduce enough sulfur into the land to cause damage, as only 10 ounces are used to the bushel. This man has raised very little else on his farm during the past 12 years, than potatoes. In one case, unrotted seed picked out of bags in which three fourths of the potatoes had a slimy soft rot, were rolled in sulfur and planted. They gave as good a stand as other potatoes taken from clean stock.

"In boy club work, in two cases boys cut and dusted seed with sulfur in tuber unit tests, conducted in rows adjacent to those of their fathers, who cut and dropped the freshly cut seed. In both cases the dusted seed gave a stand of about 92% and the undusted was reduced to about 30%.

"Another grower reports that he has always been troubled with scab. Began dusting seed pieces with sulfur 6 years ago. This year treated with $HgCl_2$ and dusted with sulfur, cleanest crop he ever raised in spite of bad scab year."

Miscellaneous parasitic diseases

Cercospora concors (Casp.) Sacc. - Found in Schuyler and one other county, New York; on upper leaves. Seemed to have followed injury to leaves due to low temperature at night. (Chupp)

Anthracnose caused by Colletotrichum atramentarium (Berk. & Br.) Taub. was observed in Stark County, Ohio.

Bacterial wilt caused by Bacterium solanacearum EFS. was collected in Maryland, South Carolina and Florida. A. C. Foster writes from Sanford, Florida, giving the following information:

> "Specimens of the wilt were collected and laboratory studies made. The wilt organism was easily identified after isolation from both tuber and stem pieces. The characteristic appearing colonies of Bacterium solanacearum made their appearance on all attempts at isolation."

Ludwig of South Carolina feels that the greatest importance of the disease lies in the fact that it unfits soil for any solanaceous crop.

Southern blight caused by Sclerotium rolfsii Sacc. was "found in Spartanburg and Charleston Counties, South Carolina. In the latter county, it is reported by Tisdale as doing 5% damage in one field." (Ludwig) Edgerton reports that the fungus is causing about 2% loss in Louisiana. In different fields the percentage varies from 0 to 10. Reference: Edson, H. A. and M. Shapovalov. Parasitism of Sclerotium rolfsii on Irish Potatoes. Jour. Agr. Res. 23: 41-46. January 6, 1923.

Sclerotial disease caused by Sclerotinia libertiana Fckl. Lachaine, C. W. Sclerotial disease of the potato. Ann. Rep. Quebec Soc. Prot. Plants. 14: 105-109. 1922.

Black dot ("dartrose") caused by Vermicularia varians Duc. B. T. Dickson (1) gives the following concerning this disease:

> "Ducomet in France in 1908 reported the occurrence for the first time of a disease which he called 'dartrose' caused by Vermicularia varians. McAlpine some two years later found it in Victoria, Australia, and Doidge more recently in South Africa. McAlpine named it 'black dot disease,' an excellent descriptive name.
>
> "In the late summer and autumn of 1921 I discovered what appears to be the same disease at Macdonald College in Quebec. This is the first time its appearance is noted on this continent and a full description will be given later elsewhere.....
>
> "Ducomet states that this organism is parasitic on tomato and Physalis peruviana. I have artificially infected tomato but have not yet tried Physalis sp.
>
> "This disease is serious only in that it weakens plants and therefore reduces the crop. Exactly to what extent it is of economic importance it is as yet impossible to state.
>
> "McAlpine advocates burning the haulms of diseased plants and selecting clean tubers for planting."

References on black dot:
(Cited)
1. Dickson, B. T. Diseases of the potato. Scient. Agr. 2: 325-327. June 1922.

(Not cited)
Crépin, C. Une maladie grave de la pomme de terre dans le nord de la Loire. Compt. Rend. Acad. Agr. France 8: 803-806. 1922.
Dickson, B. T. Plant diseases of 1921 in Quebec. Quebec Ann. Rept. 14: 52-58. 1922.
Foëx, Etienne. La dartrose de la pomme de terre. Compt. Acad. Agr. France 8: 844-848. 1922.

Wilt caused by Verticillium alboatrum Reinke and Berth. was of minor importance in New York, Ohio and Wisconsin. In Oregon, on the other hand, the fungus caused considerable loss. Van Trump reports: "Severe in western Oregon. Clackamas County Agent Holt estimates 10-15% crop loss. Fruit inspector Walker estimates 40% loss in Multnomah County. Quite severe in Marion County in the red hill soil." Freeman Weiss of the Bureau of Plant Industry reports that in Maine he saw "several fields where there were from one to two plants in 200, usually in patches with greater density than this rate, infected with wilt," which was referred to by Schultz and Folsom, who had made cultures in previous years, as Verticillium wilt.

Wilt caused by Fusarium eumartii Carpenter was found killing plants in one field in Allegany County, New York. The infection started from one hill and spread in all directions until a space of several rods in diameter was invaded. The fungus was much more virulent than Fusarium oxysporum, causing an infection of the entire base of the stem, and passing down the stolons affected the stem end of the young growing tubers. The disease is not very prevalent in the state, but appears in a few fields each season. (Chupp)

Tuber rots caused by different species of Fusarium have been observed in a number of states: Ohio, Iowa (stem-end rot, 6% loss), Minnesota (.5% loss), South Dakota (trace), North Dakota (3% loss caused by Fusarium discolor sulphureum), Colorado (common on market potatoes), and Washington (dry rot causing considerable loss).

G. E. Prince reports a Fusarium from Monte Vista Section, Colorado:

> "Quite a bit of Fusarium is being found in the Valley this season, or at least it looks like Fusarium to me, but the local inspectors have been calling it sun-scald, and seem undecided as to just what the trouble is. Reports indicate that it is scattered over the entire district but is found less in the outlying district where potatoes are being planted for the first time, and in fields where proper crop rotations have been practiced." (U.S.Bu.Agr.Econ.Fruit & Veg.Div.Letter Oct. 12, 1922)

Reference:

Kock, Gustav. Einiges über Kartoffelkonservierungsmittel. Oesterreich. Zeitschr. Kartoffelbau. 1: 37-38. 1921. (Sulfur and a number of proprietary compounds, such as Megasan K, Beka-Erdapfelschutz and Uspulunbolus, have been shown to be ineffective in preventing the development of storage rots of potatoes due to late blight, Fusaria, etc.)

Jelly end rot caused by *Fusarium radicicola* Woll. was present in Ohio, Idaho and Washington. Only slight losses were reported.

Powdery dry rot caused by *Fusarium trichothecioides* Woll. was found in seed potatoes examined at Prescott, Arizona.

Leak or rot caused by *Pythium debaryanum* Hesse or *Rhizopus nigricans* Ehrenb. was reported from Connecticut (one report), Texas (1-40% loss at digging time), Ohio, Minnesota (15% of tubers ruined in one acre plot), and Idaho (important with mid-season potatoes which are not properly handled.

Slimy soft rot caused by bacteria was, as usual, one of the most important causes of losses in transit.

Silver scurf caused by *Spondylocladium atrovirens* Harz. was of minor importance in New York, West Virginia, Indiana, Idaho, and Washington. No doubt it is present in many other states.

Powdery scab caused by *Spongospora subterranea* (Wallr.) Johnson lightly infected 5% of the tubers in a one-acre field of Irish Cobblers in St. Louis County, Minnesota. Previously to 1922 it has been reported to the Survey definitely from Aroostook and Washington Counties, Maine; Franklin, Clinton and Hamilton Counties, New York; Luzerne County, Pennsylvania; Oconee County, South Carolina; St. Louis, Lake and Carlton Counties, Minnesota; Tillamook and Clatsop Counties, Oregon; and Snohomish, King, Pierce, and Clallam Counties, Washington. *Reference*: Shapovalov, Michael. Relation of potato skin spot to powdery scab. Jour. Agr. Research 23: 285-295. 1923.

Root rot caused by *Armillaria mellea* Vahl. was found at Hudson, Wisconsin. The crop was grown in a recently cleared field.

Root knot caused by *Heterodera radicicola* (Greef) Müll. was reported from Mississippi, Louisiana, Arkansas and Washington. In Arkansas where the injury was described as a dwarfing of the plants, pimpling of the tubers, and storage injury, and the loss was estimated as 8%. *Reference*: Milbrath, D. G. The potato as one of the chief agents in the distribution of root-knot nematode (*Heterodera radicicola*). Month. Bul. Dept. Agr. Calif. 11: 268-371. Apr. 1922.

Curly dwarf (see mosaic)

Net necrosis (cause not mentioned) was much more prevalent in New Hampshire than usual. Complaints were received from all parts of the state. A trace was also observed in South Dakota and New York.

Miscellaneous non-parasitic diseases

Scald is a term used too liberally to describe certain conditions found in the southern or new potato crop, according to G. K. K. Link, who gives the following information (U. S. Bur. Agr. Econ. Food Products Inspection Service Memorandum):

> "Our own original conception of scald has been modified and we are inclined to think that there is much less scald than we once supposed. To be sure, there is a true scald. This is marked by blistering and a greenish purple discoloration of the skin and softening and a grayish to black color of the killed flesh. Scald is closely akin to black heart in symptoms and in cause. The dead areas, if superficial, usually are quite extensive. Generally scald involves a good bit of the affected tuber. The dead tissues may be soft with a turgid exterior or they may be dried into a starchy mass with a wrinkled exterior. Recently quite a bit of true scald has been found in No. 2 Florida stock which had all the earmarks of having been held a long time.
>
> "It must be remembered that several diseases caused by fungi may show symptoms very similar to those of scald. These are leak (now known to occur in southern stock), which resembles the blackheart type of scald and which shows no fungus; the wet type of Fusarium rot which resembles scald save that it is accompanied by a copious growth of mold; and Sclerotium rot, which also resembles scald somewhat and which is easily confused with it because there frequently is no fungus growth. Many leaky barrels show no fungus growth because the stock was handled so that all traces of fungus are obliterated.
>
> "Most of the confusion has come in classing a peculiar type of bruise as scald. The type of bruise is found in the early stock which is dug while it is very tender and full of water. It seems to be most prevalent in Florida Cobblers and Spaulding Rose. The spots usually are small and comparatively very deep. At times they occur in such abundance on a tuber that one is disinclined to believe that a tuber can be wounded in so many spots without being crushed. The bruises probably are due to slight pressure or jars during or immediately after digging. Usually the spots are less than half an inch in diameter, about one quarter inch being most common, and range from one-eighth to about three-eighths inch in depth.
>
> "The skin of such spots is not broken and has a bluish appearance. The spots are sharply sunken, that is, the edge of the depression is almost at right angles to the tuber's surface. The spots remind one very much of deep holes in a granite block pavement. The interior appearance of this spot varies with external conditions. If these are dry there usually is a thin layer of healthy flesh about 1/32 inch thick, immediately under the skin. Under this lies a starchy deposit which is gray and which extends beyond what externally appears to be the boundary of the spot. In cross section the deposit

> is lens shaped (doubly convex). If one cuts near the edge of the spot, the deposit can be pried out so as to leave a smooth, clean cavity. The surface of the deposit is inclined to be brownish yellow and corrugated and consequently the spot in cross section shows a grayish mass surrounded by a brown border which at the top is separated from the skin by a thin layer of healthy tissue. Cultures of these spots have demonstrated that the dead tissues are sterile. If external conditions are wet infection usually sets in and the thin healthy line of tissue disappears, the entire deposit becomes brown and the whole region becomes soft and discolored. Fusarium rot, Sclerotium rot, and slimy soft rot usually invade the spots."

Hollow heart (physiological) was observed in New York, Wisconsin, and Washington. The following comments regarding it are interesting:

> "F. S. Kinsey, Supervising Inspector in Washington and Oregon, advises that some hollow-heart is being found this season in Yakima Valley potatoes. Opinions differ as to whether this condition is unusually prevalent compared with previous years, but it seems to be certain that very few (if any) shipments can be certified as U. S. No. 1 grade.
>
> "The first killing frost in the Valley did not occur until October 27, the latest date on record in that section. An opinion prevails locally that too-long a growing period is largely responsible for the production of hollow-heart potatoes."
>
> "Robert Bier, superivising the shipping-point inspection of potatoes in western New York, writes of the prevalence of a certain amount of hollow heart. He says that the local inspectors have found that usually a hollow heart potato has a deep depression or more growth cracks at one end. In every case, the pronounced depression is evident. Upon russet stock it is easy to determine this defect, but upon round white stock these outward indications sometimes fail."
>
> (U. S. Bur. Agr. Econ. Fruit & Veg. Div. Letter. Nov. 9, 1922)

An internal brown spot (cause undetermined) was found in South Carolina, Oregon and Washington. Barss, in Oregon, adds the following information:

> "Mr. E. R. Jackman, inspector for potato certification, reports a serious potato trouble in which brown spots are present in the interior of the tuber as present in Malheur County. Many fields were graded down because of this and rather heavy financial loss resulted in some cases. It appeared to him more abundant in crops from certain lots of seed."

Black heart (physiological) was reported from Massachusetts, New York, Virginia and Wisconsin. No doubt the trouble was as widespread as was the shipping and storing of tubers. Bennett, J. P. and E. T. Bartholomew.((Abstract) Phytopath. 12: 443. September 1922) give the following information concerning black heart of potato:

> "The temperature-time-oxygen relation in the production of blackheart appears to be fairly definite. Between 40° C. and 50° C. decreasing temperature increased the period of exposure required to induce blackheart from eight to seventy-seven days; temperature below 5° C. decreased this period. At temperatures below 35° C. blackheart did not occur until practically complete exhaustion of the oxygen in the chamber; with increase of temperature above 30° C. an increasing amount of oxygen remained at the time of appearance of blackheart. Injury leading to the development of blackheart appears to be due to anaerobic processes in the tissues. At temperatures at which exhaustion of oxygen from the chamber precedes the appearance of blackheart, the injury may appear in any part of the tuber; at higher temperatures it usually occurs centrally."

Drouth injury was found in Ohio, Indiana, lower Michigan, Idaho and Washington. H. G. MacMillan gives the following facts concerning weather relations to potatoes (Phytopath. 12: 445. September 1922):

> "Temperature and factors influencing temperature appear to affect the potato yield in Colorado. A critical study of meteorological factors and potato production indicates that temperature for at least six months prior to planting is reflected in the condition of the crop and the yield. Summer temperatures have much less effect....."

Reference: Bellair, Georges. Observations sur la résistance de quelques variétés de pommes de terre à la sècheresse. Jour. Soc. Nat. Hort. France 23: 197-199. May 1922.

Heat necrosis resulting from high temperatures was reported from Idaho by L. G. Schultz.

Hail injury did some damage in western New York and in northwestern Minnesota.

Freezing injury is discussed by R. C. Wright and George F. Taylor in U. S. Dept. Agr. Bul. 916. 1921, who add the following:

> "The results of a study of freezing injury to 7 commercial Irish potato varieties indicate that potatoes can be undercooled several degrees below their true freezing point without freezing injury, provided there is no ice formation within the tissue. When potatoes are thus undercooled, a more or less slight jar is liable to cause freezing or ice formation. When freezing commences in an undercooled potato, the temperature quickly rises to its true freezing point and remains there for a varying length of time, depending upon the surrounding temperature. Some varieties seem to freeze more readily than others when undercooled."

Lightning injury was observed in New York, New Jersey, Pennsylvania, Minnesota, and Wisconsin. The very characteristic spots in the fields are familiar to most growers and pathologists.

Spray injury caused by Paris green was reported only from Minnesota, but is present in every state where Paris green is used.

Fertilizer burning was responsible for some poor stands of potatoes on Long Island. (H. C. O'Dell) Reference: Brown, B. E. Effect of borax in fertilizer on the growth and yield of potatoes. U. S. Dept. Agr. Bul. 998. July 3, 1922.

General references on potato diseases

Berger, A. Culture des pommes de terre. Vie Agr. & Rur. 21: 65-66. July 1922.

Butler, O. R. Work in potato diseases. New Hampshire Sta. Bul. 203: 19-21. 1922.

——— Bordeaux mixture II. Stimulating action. New Hampshire Agr. Exp. Sta. Tech. Bul. 21: 3-50. 1922.

Clinton, G. P. New facts concerning diseases of vegetables and their control. Rep. Conn. Veg. Grow. Assoc. 1921: 7-20. 1922.

Cook, Mel. T. Field studies on potato diseases. Ann. Rept. New Jersey Agric. Exp. Sta. 41: 573-577. 1921.

Cotton, A. D. Potato pink rot: a disease new to England. Jour. Min. Agr. Gt. Brit. 28: 1126-1130. March 1922.

Cuthbertson, William. Lessons for practical men from the International potato conference. Fruit Grow. Fruiterer Flor. & Mark. Grow. 54: 59-60. July 13, 1922.

Dickson, B. T. Diseases of the potato. Sci. Agr. 2: 55-57, 93-96, 163-167, 202-206, 234-236, 310-312, 325-327, 417-419. 1921-1922.

Dietrich, F. O. Ueber die erkrankung der kartoffeln. Mitt. Deut. Landw-Ges. 37: 614-616. October 14, 1922.

Dubois, P. Maladies de dégénérescence de la pomme de terre. Vie Agr. & Rur. 20: 187. March 18, 1922.

——— La lutte contre la "dégénérescence" des pommes de terre dans l'ouest de la France. Rev. Bot. Appl. 2: 586-589. Oct. 1922.

Ducomet, Vital, and Etienne Foëx. Note sur les maladies de la dégénérescence de la pomme de terre. Rev. Bot. Appl. 2: 325-330. July 31, 1922.

Ducomet, Vital. Observations et expériences sur les maladies de dégénérescence de la pomme de terre. Bul. Soc. Path. Vég. France 9: 29-38. January-March 1922.

——— Les maladies de dégénérescence de la pomme de terre. Rev. Hist. Nat. Appl. pt. 1, 3: 274-283. September 1922.

Dufrénoy, Jean. Les maladies des pommes de terre dans les Hautes-Pyrénées (août-septembre 1921). Bul. Soc. Path. Vég. France 8: 137-138. February 1922.

Evans, A. T., C. Janssen, and Matthew Fowles. Potatoes in South Dakota. So. Dakota Agr. Exp. Sta. Bul. 196: 375-415. February 1922.

Foëx, Etienne. Les gales de la pomme de terre. Jour. Agr. Prat. 149 (n. s., 39): 73-75, 93-94, 111-113. July 22-29, 1922.

Hardenburg, E. V. A study by the crop method of factors influencing the yield of potatoes. New York (Cornell) Agr. Exp. Sta. Mem. 57: 1143-1279. 1922.

Hungerford, Charles W. Leafroll, mosaic, and certain other related diseases in Idaho. Phytopath. 12: 133-139. 1922.

——— Some newer aspects of the potato disease situation. Proc. Ann. Meet. Washington State Hort. Assoc. 16 (1920): 266-270. 1921.

Johnson, James. The relation of air temperature to certain plant diseases. Phytopath. 11: 446-458. 1921.

Johnson, T. C. Diseases of Irish potato. Trans. Penin. Hort. Soc. 35 (1921): 147-152. 1922.

McKay, M. B. Potato diseases in Oregon and their control. Oregon Agr. Exp. Sta. Cir. 24: 53p. February 1922.

Melchers, L. E. Potato diseases prevalent in Kansas, and their control. Bienn. Rep. Kansas State Hort. Soc. 36. (1920-21): 124-125. 1922.

Miège, Emile. Sur une maladie de la pomme de terre observée au Maroc Bul. Soc. Path. Vég. France 9: 109-112. April-June, 1922.

Mottet, Seraphim. La dégénérescence de la pomme de terre Jour. Soc. Nat. Hort. France IV, 23: 263-268. July 1922. (Trans. Gard. Chron III 73: 25-26, 38-39. 1923)

Murphy, Paul A. Investigation of potato diseases. Dept. Agr. Canada Exp. Farms, Bul. 44: 7-86. 1921.

__________ Leaf-roll and mosaic, two important diseases of the potato. Jour. Dept. Agr. Tech. Instr. Ireland 22: 281-284. November 1922.

Orton, W. A. New work on potato diseases in America. Rept. Internat. Potato Conference. P. 109-179. Roy. Hort. Soc.: London, 1921 (1922).

Perret, Claude. La dessiccation prémature des pieds de pommes de terre. Compt. Rend. Acad. Agr. France 8: 848-851. Nov. 1922.

__________ La dégénérescence des pommes de terre. Bul. Soc. Path. Vég. France 9: 39-41. January-March 1922.

Quanjer, H. M. New work on leaf-curl and allied diseases in Holland. Royal Hort. Soc. Rpt. Internat. Potato Conf. London, Nov. 16-18, 1921, p. 127-145.

Salaman, Redcliffe N. Degeneration of potatoes. Rept. Internat. Potato Conf. p. 79-91. Roy. Hort. Soc.: London, 1921 (1922).

Sandsten, E. P. and C. M. Tompkins. Degeneration in Colorado potatoes. Colorado Agr. Exp. Sta. Bul. 278: 1-15. 1922.

Schander, Richard. Kartoffelkrankheiten in frühsomme 1922. Landw. Zeit. 42: 227. July 15, 1922.

Schribaux, Emile. Sur la dégénérescence des pommes de terre. Compt, Rend. Acad. Agr. France 8: 397-398. 1922.

Stakman, E. C., J. G. Leach, and J. L. Seal. Fruit and vegetable diseases. Minnesota Agr. Exp. Sta. Bul. 199: 1-73. June 1922.

Stuart, William. Potato breeding, selection and seed development work in the United States. Rept. Internat. Potato Conf. 1921. p. 15-26. 1922.

Taylor, G. M. Degeneration of the potato. Gard. Chron. III 73: 54. 1923.

Winberg, O. Contre la dégénérescence de la pomme de terre. Jour. Agr. Prat. 87: 57-58. January 20, 1923.

Wollenweber, H. W. Krankheiten und beschädigungen der kartoffel. Arb. Forschungsint Kartoffelb. no. 7. 56 p. 1923

Anon. Plant disease investigations at the North Dakota Station. North Dakota Sta. Bul. 159. 1922.

DISEASES OF TOMATO

Leaf spot caused by Septoria lycopersici Speg.

The reports each year show that the area comprising New Jersey, Maryland, Delaware, West Virginia, Virginia, Kentucky, Tennessee, North and South Carolina, Ohio, and Indiana suffers great losses because of leaf spot. The year 1922 was in general no exception in this respect.

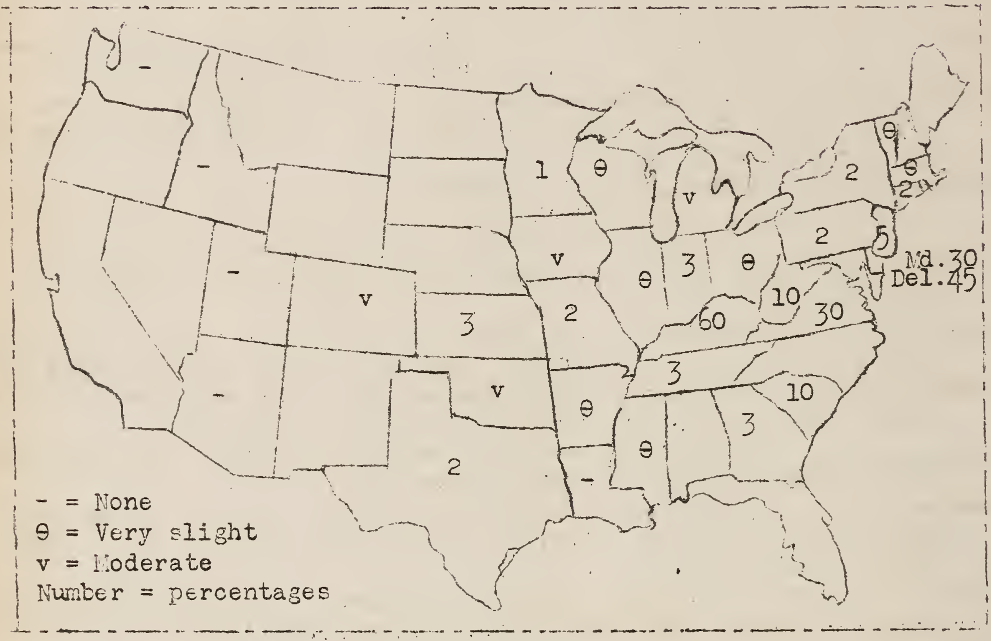


Fig. 5. Estimated losses from leaf spot in the United States in 1922.

Massachusetts: Of comparatively rare occurrence out-of-doors. First observed several years ago in greenhouse. (Osmun)

Virginia: Tomatoes in home garden at Bedford were almost completely defoliated on July 14. (Fromme)

Indiana: Serious factor in gardens and canning crop. Worse in southern half of state, especially extreme southern end; but prevalent everywhere. Noted very destructive in Marion and Gibson Counties in August. Defoliation worse on poor soils in Gibson County. (Gardner)

(See also Plant Disease Bulletin 6: 83-84, 91-92, 127. 1922)

Weather relations

Following are a few reports given by collaborators regarding weather relations to Septoria:

New Jersey: Moisture normal during infective period - heavy dews. Warm days and cool nights. (Poole)

Delaware: Heavy rains in July very favorable to prevalence. (Adams)

Maryland: Eastern half of state wet during summer. (Temple & Jehle)

West Virginia: Wet spring and early summer; cold spring.

Arkansas: Weather dry and hot. (Elliott)

Indiana: Drouth checked spread of disease. High temperature favorable. (Gardner)

Michigan: Checked in southern Michigan by dry weather. (Nelson)

Table 21. Dates of earliest appearance of tomato leaf spot in the United States in 1922.

Date	Place	Date	Place
May 19	Terre Haute, Indiana	July 20	New Castle, Delaware
June 14	Gloucester County, New Jersey	July 21	Chautauqua County, New York
June 20	Clinton County, Illinois	July 24	Stevens County, Minnesota
July 6	Boonville, Missouri	July	Fort Collins, Colorado
July 20	Madison, Wisconsin	Sept. 10	Vermont

Control measures

There is a general agreement that spraying with Bordeaux mixture and fish-oil soap gives excellent results. The control obtained by dusting has not been the same in all cases.

New Jersey: This disease has been very serious during the past three years. Treatment for control is practiced in a few sections of the state. Very good control has been obtained with 4-4-50 Bordeaux plus 1-1/2 lbs. fish oil soap. (Poole)

Delaware: Copper dust gave promising results in two fields. (Adams)

Kentucky: Defoliation reduces set and causes burning of fruit. Five dustings on each of four plantings of tomatoes with Bordeaux gave no appreciable control of leaf spot. (Valleau)

Indiana: H. D. Brown reports control in Washington County by spraying the plant beds. Field loss reduced by fertilizer and manure. (Gardner)

Michigan: Effectively controlled by Bordeaux plus resin-fish-oil soap. (Nelson)

Fusarium wilt caused by Fusarium lycopersici Sacc.

According to collaborators' estimates, serious losses of tomatoes due to wilt are confined, in 1922, mostly to states bordering the lower Mississippi and Ohio Rivers. In addition there are moderately heavy losses in Kansas, Texas, South Carolina and the Chautauqua district of New York.

New York: Rather general, especially in the Chautauqua tomato district. (Chupp)

New Jersey: In Gloucester, Camden, and Burlington Counties also scattered in other counties. (Poole)

Maryland: Occurred in eastern half of state. (Temple & Jehle)

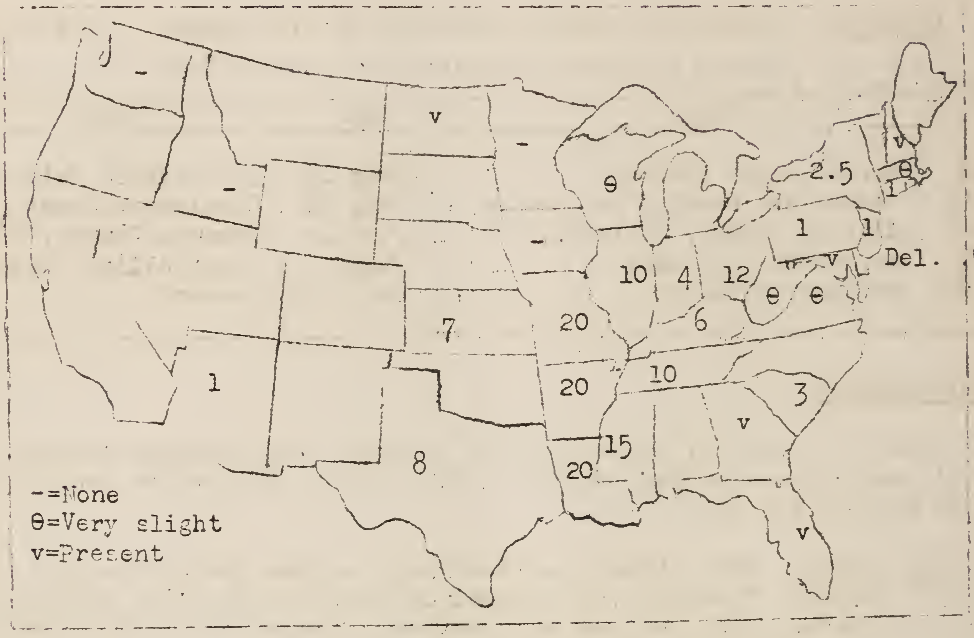


Fig. 6. Severity of Fusarium wilt in the United States in 1922.

Virginia: General in Essex County also reported from Richmond. (Fromme)

West Virginia: Rather unimportant. Found locally, mostly in Brooke County. Some Marvel Wilt resistant proved very satisfactory. (Department Plant Pathology)

Florida: This disease was prevalent all over the state this past season. (Burger, August 1922)

Mississippi: General in most every garden in state where resistant varieties are not used. Resistant varieties,- viz, Pritchard and Edgerton selections, continue to give good satisfaction, and many gardeners by using them are able to grow good crop on badly infected soil. (Neal)

Texas: Very prevalent. Almost epidemic, 15% loss. (Taubenhaus)

Indiana: State wide. Some districts still free from wilt, such as Orange and Washington Counties. (Gardner)

Illinois: Most important disease from commercial standpoint. (Anderson and Tehon)

Wisconsin: A few scattering plants seen and others reported. Of little importance in Wisconsin. (Vaughan)

(See also Plant Disease Bulletin 6: 60, 83, 92, 128. 1922)

The most favorable weather conditions according to reports are drouth and high temperature.

Missouri: In districts affected by drouth very severe. (Maneval)

Indiana: Drouth favorable. Hot July, August, September favorable. (Gardner)

Table 22. Dates of earliest appearance of Fusarium wilt in 1922.

Date	Place	Date	Place
April	Fort Smith, Arkansas	June	Burlington Co., N. J.
May 16	Louisiana	July 13	Hamilton County, Ohio
May 18	A. & M. College, Mississippi	July 22	Jefferson County, Ill.
May 24	Indianapolis, Indiana	July	Seaford, Delaware
May 29	Columbia, South Carolina	Aug. 4	New Haven, Connecticut
June 13	Crawford, Kansas	Aug. 19	Mandan, North Dakota
June 15	Missouri		

Varietal susceptibility

The ideal goal to be sought in the control of diseases is the procuring of immune varieties. Even though the breeding work has only begun wonderful results have been obtained with such vegetables as cabbage, beans, watermelon and others. Some exceptionally good work has been done also with tomatoes, and according to the reports, the selected varieties are proving entirely satisfactory.

New Jersey: Observed on Bonny Best, Baltimore, Earliana, and Stone. (Poole)

West Virginia: Some Marvel wilt-resistant proved very satisfactory.

Kentucky: Marvel seemed to be resistant and satisfactory in other ways in greenhouse. (Valleau & Gardner)

Mississippi: Resistant varieties, viz., Pritchard and Edgerton selections continue to give good satisfaction. Many gardners by using them are able to grow good crops on badly infested soil. (Neal)

Louisiana: Louisiana resistant varieties very successful. (Edgerton)

Arkansas: Norton and Louisiana Red and some other selections resistant. (Elliott)

Indiana: Large acreages grown for the Heinz Company in Gibson County are being infested with wilt by use of plants from Henderson, Kentucky. Columbia, Norton and Norduke varieties showed resistance, as compared with Greater Baltimore, although none were entirely free from wilt. (Gardner)

Illinois: Resistant varieties developed by the Dept. Hort. held up well again this year. (Anderson and Tehon)

Missouri: One to ten percent of crop injured. Globe more resistant than Stone, Ponderosa, Bonny Best and John Baer, the common varieties. Data by J. T. Rosa. (Maneval)

Resistant varieties from U. S. D. A.; Norton, Columbia, Marvel all showed fair resistance but quality of first not uniform nor very good. Data by E. M. Page. (Maneval)

Control measures

Wilt being caused by a soil organism, resistant varieties are the only feasible means of control. Soil disinfection and rotation may also be practiced to a limited extent.

Indiana: In greenhouses, bringing in new soil, changing locations of houses failed to control. In one new house, disease was introduced with transplants. In canning crop, wilt is usually associated with the use of southern grown plants. At LaFayette evidence was obtained that most of the soil infestation disappeared after four years without tomatoes, but not all,- one case of wilt occurred. (Gardner)

References

Norduke, a new variety of wilt-resistant tomatoes. U. S. Dept. Agr. Clip Sheet 1921. Feb. 20, 1922.

"In the course of work on the selection of tomatoes that will resist the wilt disease, which causes a large annual loss in the tomato-canning States, the United States Department of Agriculture has developed a variety called Norduke, similar to Stone, but highly resistant to wilt. Four other wilt-resistant varieties have already been produced, known as the Marvel, which is a medium early tomato selected from Merveille des Marchés, bearing a heavy yield of large, smooth, red fruit; the Norton selected from Stone, producing a heavy yield of large, smooth solid red fruit, which ripens slowly, and therefore ships well; and Columbia and Arlington, medium late varieties, selected from Greater Baltimore.

Pollock, N. A. R. Some notes on Fusarium in the tomato plant in north Queensland. Queensl. Agr. Jour. 18: 10-12. July 1922.

Infection probably occurs most frequently through damaged roots. Dipping in a solution of one part $CU\ S\ O_4$ to 500 parts water when transplanting, and watering with the same or a weaker solution did not give complete control, but it was noted that treated plants were longer in developing the disease.

Pritchard, Fred J. Development of wilt resistant tomatoes. U. S. Dept. Agr. Bul. 1015: 18. 1922.

"The characteristics and distribution of the disease, source of infection, and persistence of the fungus in the soil are discussed.....The Marvel, Columbia, Norton and

Arlington varieties developed by the author; and Louisiana Red, Louisiana Pink, and Tennessee A 16-2, proved resistant to wilt and suitable for commercial purposes." (Abst. in Bot. Absts. 11^{5}: Entry 2893. 1922)

Western yellow blight (cause not definitely determined)

Western yellow blight is reported from Idaho (5% loss), Utah (1% loss), Oregon and Washington. The cause, judging from reports, is not definitely known. From Washington it is given as Corticium vagum; from Oregon, Fusarium et al ?; and from Idaho, Fusarium sp.

Oregon: Damage most severe in sections east of the Cascade Mountains from Columbia Basin to Klamath County. In the Wasco County sections were reported as less severe than usual in most cases. Supt. Dean of Umatilla Branch Station at Hermiston says it is not serious "where crops have some shade and soil is fertilized. Damage otherwise 50 to 100%." (Barss)

Washington: Becoming more prevalent about Pullman and vicinity but not as prevalent as in other years. 1% loss. (Dana)

Reference: Heald, F. D. (Washington Col. Sta. Bul. 167: 38-43. 1922. The results of continued observations on the western blight or yellows of tomato are given in which the author reports the failure to secure cultures of Rhizoctonia. Isolations made from diseased material showed that both Rhizoctonia and Fusarium are present, and the possibility of the two fungi acting together to produce the disease is being investigated.

Early blight and nailhead spot caused by Macrosporium spp.

Early blight and nailhead spot was less severe in nearly all states excepting New York, where the Alternaria fruit spot became so prevalent that canning companies in the Ontario lake district refused to accept the tomatoes which the farmers were delivering. Below the surface spot on the fruit was a blackened streak extending through the flesh and making the tomatoes unfit for anything but catsup.

New York: Leaf spot, and particularly a fruit spot, wherever tomatoes are grown. So great was the loss that the Canners' Association has asked for the services of a pathologist during the growing season next year.

Jefferson County: Serious infection this year and last. (Chupp)

New Jersey: General, of most importance in Burlington, Camden and Gloucester Counties. Wet in early season. The mold is associated with sun scald. Infected fruit rots if conditions are favorable to the organism. Usually the infected fruit dries up on the field, where it is left by the pickers. (Poole)

West Virginia: Generally later in appearance and less destructive than last year on early crop. Very little fruit injury. More common and more destructive on the early crop than the leaf spot except in few instances. (Sherwood)

Indiana: Mainly as a fruit spot; also as collar rot. An Alternaria fruit spot serious late in season and assumed to be due to *A. solani*.

Spots oval or circular, sunken, smooth, with an even margin, and black or brown in color. When very small margin may be lobed usually on late-maturing fruits. Alternaira isolated repeatedly.

Collar-rot, probably due to this fungus, occurred in same locality where it occurred last year - Hancock County, on June 26, and is attributed to plant bed infection of seedlings. (Rosenbaum, J. A. Macrosporium foot-rot of tomato. Phytopath. 10: 415-522. 1920.) (Gardner)

Mississippi: Defoliation of plants, especially early varieties,- spotted. Mostly in southern counties. Several fields in Hinds, Copiah, Harrison, and Pearl River Counties were rather seriously affected, causing defoliation. (Neal)

Texas: This disease was found in cold frames of tomato plants and in sweet potato beds in east Texas. It is similar to the one described by Rosenbaum and Pritchard on the tomato. From isolation and infection studies of the Texas material, it was found that *Macrosporium solani* was the only organism present in both the sweet potato and tomato material. Little difficulty was experienced in infecting healthy plants of both hosts with this fungus. (Taubenhaus)

Table 23. Prevalence of early blight and nailhead spot in the United States in 1922.

State	% loss	State	% loss	State	% loss
New Hampshire	Trace	West Virginia	10	Ohio	Not serious
Massachusetts	"	Kentucky	0	Indiana	Present
Connecticut	.5	Tennessee	2	Illinois	4
New York	10	Florida	Present	Wisconsin	Trace
New Jersey	3	Mississippi	3	Minnesota	"
Delaware	General	Louisiana	1	Iowa	Present
Maryland	Trace	Texas	1	Kansas	"
Virginia	2	Arkansas	Trace	Idaho	0
				Washington	0

Table 24. Dates of earliest appearance of early blight and nailhead spot in 1922.

Date	Place	Date	Place
May	Gloucester County, New Jersey	July 28	Riley, Kansas
June 1	Wood County, West Virginia	July	Tompkins County, New York
June 1	Summit County, Ohio	Aug. 4	Seaford, Delaware
June 10	Jackson, Mississippi	Oct. 4	Marion County, Indiana
June 17	Washington County, Illinois		

Varietal susceptibility

No definite information about varietal susceptibility was submitted.

New York: Ponderosas and Nortons transplanted side by side on same day. Ponderosas almost defoliated, while Nortons were almost free. (Chupp)

Mosaic

(See also mosaic of potato, especially references)

Mosaic of tomatoes is of considerable importance in many areas, both in the field and the greenhouses.

New Jersey: Aphis are no doubt closely related to the dissemination of this disease in New Jersey. The "streak" and filiform conditions are considered to be related. The latter two are serious in greenhouses, especially on winter grown tomatoes. As high as 95% loss was observed in several greenhouses in December. (Poole)

Indiana: Yield reduced. Fruit lesions noted both in greenhouse and field crops. Worse in central part of state. (Gardner)

Illinois: Throughout the state, especially common in greenhouse. (Anderson and Tehon)

Missouri: Severe infections in greenhouses under forcing conditions. General in several localities, 2 to 25% of crop injured. Data by J. T. Rosa. (Maneval)

Kansas: Only fairly common and causing but little damage, in spite of many plants showing mosaic symptoms. (R. P. White)

Oregon: Reported as slight from Willamette Valley and Umpqua Valley. (Barss)

(See also Plant Disease Bulletin 6: 59, 84, 112, 128. 1922)

Table 25. Prevalence and importance of tomato mosaic in 1922, according to collaborators.

State	% loss	State	% loss	State	% loss
Connecticut	Present	West Virginia	Slight	Michigan	Not extensive
New York	10	Louisiana	5-10	Minnesota	1
New Jersey	16	Arkansas	Trace	Iowa	Very important
Pennsylvania	Very prevalent	Ohio	Not marked	Missouri	2-25
Delaware	5	Indiana	2	Kansas	Present
Maryland	Trace	Illinois	Trace	Idaho	More than usual
				Oregon	Present

Table 26. Dates of earliest appearance of mosaic during 1922.

Date	Place	Date	Place
May 3	Cuyahoga County, Ohio	June 8	Missouri
May 10	Cass County, Indiana	July 24	Cloud, Kansas
May 16	Louisiana	July 27	Branford, Connecticut
May 22	Ramsey County, Minnesota	Aug. 4	Seaford, Delaware
May	Gloucester County, New Jersey	Aug. 29	Kings County, New York

Control measures

In tomato mosaic it has been proved definitely that weeds are harborers of the virus. The question arises as to whether more weeds will not be found associated with different diseases, the control of which will depend upon the eradication of the weed hosts.

Indiana: A field control experiment in which an active campaign was waged against weed carriers resulted as follows: Aug. 29, .43% mosaic in field 1 (ten acres) and 1.8% in field 2 (5 acres) as compared with 14.2% in field 3 (30 acres). Fields 1 and 2 were weeded, field 3 was check. Abundant evidence against horse nettle as well as ground cherry, as carriers of mosaic. (Gardner)

Minnesota: Heavily infected Solanum nigrum associated with diseased tomatoes. (Section of Plant Pathology)

Idaho: Important in some sections. Found on Solanum nigrum in several tomato fields. (Hungerford)

References

Bewley, W. Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.

Gardner, M. W. and J. B. Kendrick. Indiana Sta. Bul. 261: 24 p. 1922.

A number of annual and perennial solanaceous plants have been found that are subject to mosaic. Of these the perennial species are considered of most importance on account of the wintering over of the rootstocks. Several species of ground cherry (Physalis spp.) and the horse nettle (Solanum carolinense) are common weeds in tomato fields in Indiana, and their eradication, together with any related species, is recommended. Suggestions are also made for seed bed and greenhouse control of this disease. (Abstract Exp. Sta. Rec. 47. Oct. 1922)

____________ Overwintering of tomato mosaic. Bot. Gaz. 73: 469-485. June 1922.

Blossom end rot (non-parasitic)

Not many definite estimates were given of the losses incurred through blossom end rot but the average loss was evidently not so high as last year.

The cause is considered as ecological, but the collaborators are not all agreed as to the exact conditions which produce the disease.

New York: Where Ponderosas were defoliated with Alternaria there was no blossom end rot, but Nortons free from Alternaria and growing on adjoining rows fruit damaged 30 to 40%. (Chupp)

New Jersey: The disease has been observed on Stone, Earliana, Bonny Best, and Baltimore varieties. It is most severe in greenhouses, where from 20 to 50 per cent loss occurred. (Poole)

Virginia: Frequent rains prevalent, severe injury. (Fromme)

West Virginia: About usual amount seen and very generally distributed over the state. (Sherwood)

Georgia: Very common and caused serious loss; in many instances from 50 to 80% of the early crop. (McHatton)

Mississippi: All varieties appear to be affected to about the same degree. Blossom end rot is second in importance to wilt. (Neal)

Oregon: General but not apparently as severe as usual perhaps due to the fact that dry weather prevailed from the time the plants were set out thus forestalling an unbalanced condition later. (Barss)

Table 27. Prevalence of blossom end rot of tomatoes in 1922.

State	% loss	State	% loss	State	% loss
Vermont	Slight	Mississippi	10-12	Michigan	Present
New York	2-3	Texas	Present	Wisconsin	Minor
New Jersey	Common	Arkansas	4	Minnesota	Slight
Ohio	Slight	Indiana	Severe under glass	Iowa	Present
Virginia	Slight			North Dakota	Severe locally
West Virginia	2			Idaho	Present
South Carolina	6	Illinois	1	Washington	Two reports
Georgia	Serious			Oregon	General

Table 28. Dates of earliest appearance of blossom end rot in 1922.

Date	Place	Date	Place
May 27	A. & M. College, Mississippi	August	Tompkins County, New York
July 6	Calhoun, South Carolina	Sept. 1	Madison, Wisconsin
July 7	Ramsey County, Minnesota	Sept. 15	Vermont
Aug. 15	Page, North Dakota	Oct. 8	Tuscarawas County, Ohio

Reference

Bewley, W. Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.

Leaf mold caused by Cladosporium fulvum Cke.

Leaf mold is not an important disease, although in the greenhouse it may become troublesome if the humidity of the atmosphere becomes too high. The disease was reported from Massachusetts, Connecticut, New York, New Jersey, Kentucky, Florida, Louisiana, Ohio, Indiana, Iowa, and Kansas.

> New Jersey: This disease has been common on greenhouse grown tomatoes in this state for several years. It is especially abundant on tomatoes maturing in October and November. Only slight infections have been observed in the field. (Poole)
>
> Florida: There are 24 acres under cloth and slats. The plants were set about middle of August after tobacco. They have been dusted once a week with Paris green (1 to 3 lbs. per acre). The mold has appeared within the last two weeks and will cause damage if the frost does not kill the plants during the next month. (W. B. Tisdale, October 24, 1922)
>
> Louisiana: Common and in a few localities very severe. In the worst infected region, one patch was practically killed. In most sections of the state, however, the leaf mold was only of minor importance. (Edgerton)

Reference

Bewley, W. Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.

Bacterial blight caused by Bacterium solanacearum EFS

In none of the eleven states from which bacterial blight was reported was it serious. In Maryland it was first observed in Wicomico County, July 28. In one field the infected plants averaged 25%. The average loss for the state was a trace. In Virginia a trace, and in West Virginia two fields were observed in Barbour County with about 33-1/3% loss. In South Carolina it was fairly common, being observed first June 3; in Georgia general and serious in home gardens; in Florida it was reported from several localities; in Mississippi it was not observed; in Louisiana, only scattered infections (1% loss), the first of which were observed May 22; in Texas, Taubenhaus reports only a trace; in Indiana, it being found serious in one greenhouse, isolation and inoculation experiments were conducted which proved the pathogenicity of the organism in question; and in Arizona 1% loss was recorded.

Rootknot caused by Heterodera radicicola (Greef) Müll.

Root knot is reported from New Jersey, West Virginia, South Carolina, Mississippi, Louisiana, Texas, Ohio, Indiana, Kansas, and Washington. Percentages of loss are 5% in South Carolina, 1% in Mississippi and Texas, and 5 to 10% in Louisiana. Following are the comments by collaborators: New Jersey (Poole) "No record was obtained of infestation of plants in field. Heavy losses amounting to 50% have been observed in a few greenhouses." Mississippi (Neal) "Stunted plants, poor or no yield. One report this season from Waynesboro causing serious loss in a three-acre field. Ohio (Thomas) "Found only in greenhouses, successfully controlled by steam sterilization. Indiana (Gardner) "Serious in greenhouses; occasional in field. H. D. Brown is publishing a Purdue Station Bulletin on greenhouse soil sterilization with steam pipes and tile to control nematodes." Kansas (White) "Nematodes seem to be quite prevalent in Reno County, cause considerable damage. Trouble has been had in the greenhouse as well as the field with nematodes."

Reference

Sandground, J. A study of the life-history and methods of control of the root gall nematode, Heterodera radicicola (Greef) Müll. in South Africa. So. Afr. Jour. Sci. 18: 399-418. 1922.

Other diseases - those affecting stems

Fuligo septica L., a slime mould, smothered plants in the seedbed in Washington County, Ohio.

Winter blight, stripe or streak (cause unknown) has been reported from New Jersey, New York, and Kansas. In New Jersey Poole says: "A diseased plant is occasionally found in large fields. It is serious in both fall and spring crops of tomatoes in greenhouses. As high as 95% of plants in a few greenhouses were affected with the disease." The following references are given:

W. Bewley. Tomato diseases. Jour. Royal Hort. Soc. 47: 169-174. 1922.

Paine, S. G. and M. S. Lacey. Studies in bacteriosis VII. Comparison of the "stripe disease" with the "Grand Rapids disease" of tomato. Ann. Appl. Biol. 9: 210-212. 1922

Bacterial wilt caused by Aplanobacter michiganense EFS was reported July 24 from Grand Rapids, Michigan. It is commonly the cause of wilted plants in Grand Rapids greenhouses.

Collar blight caused by Rhizoctonia solani Kühn was found very prevalent in seed beds in Delaware. In New Jersey, Rhizoctonia caused a damping off of seedlings in hot beds. The loss was slight. Both collar rot and damping off were found in New York.

Leaf roll (cause unknown) was very severe from about the middle of July to the first of August at Manhattan, Kansas, according to a report from R. P. White.

Damping off of seedlings. Bewley (Bewley, W. Jour. Roy. Hort. Soc. 47: 169-174. Sept. 1922.) says: "This disease is caused by a number of different fungi, but mainly those belonging to the genus Phytophthora and especially P cryptogea Pethybridge and P. parasitica Dastur."

Damping off attributed to Pythium debaryanum Hesse was reported from New Hampshire.

Sclerotium blight caused by Sclerotium rolfsii Sacc. was observed June 15 in one field in South Carolina.

Hollow stem caused by drouth and spindling transplants was serious locally in Indiana. According to Gardner the growers often mistake it for Fusarium wilt.

Frost injury - early plantings of tomatoes were badly injured in the Imperial Valley, California (C. L. Brown, Bur. Mark. & Crop Est., Div. Letter 3: 31. 1922)

Lightning injury - found by Gardner, July 7, at LaFayette, Indiana.

Water injury - In Caroline and Dorchester Counties, Maryland, tomatoes were greatly damaged by floods and heavy rains. Losses estimated at 50 to 75% of crops. Septoria came on badly afterwards.

Other diseases - those affecting fruit or blossoms

Late blight caused by Phytophthora infestans (Mont.) De Bary. The disease was reported from only four states in 1922. In New York and New Jersey there were only traces of the disease. In Virginia there was much loss on the higher altitudes of the southwest section, a maximum of 75% injury being found in some fields. In West Virginia it started late, so that in many cases it was checked by dry hot weather. The estimated loss was 5%. None was found in Ohio. It was interesting to note that in Virginia copper-lime dust gave good control.

Phoma fruit rot caused by Phoma destructiva Plowr. was found in New York, New Jersey, Virginia, Arkansas, Ohio and Iowa. In New York it was found on cracked fruit, destroying 2 to 3%; and in Arkansas it was severe, the maximum rot found in any one field being 5%. In the other states the loss was only slight. Ohio (Thomas) - "Fruit rot was found in Washington County this year. This disease had not been previously noted to have occurred in the state. Only slight loss resulted this season." Arkansas (Elliott) - "Common, causing considerable rot." Virginia (Fromme) - "Common but of relatively minor importance." New Jersey (Poole) - "Only few specimens of serious rot found in Burlington County and at Experiment Station." (Reference: Link, G. K. K. and F. C. Meier. Phoma rot of tomatoes. U. S. Dept. Agr. Dept. Circ. 219. 1922.)

Anthracnose caused by Colletotrichum phomoides (Sacc.) Chester. - was observed in New Jersey, Indiana and Kansas. Poole of New Jersey states that "The disease caused 25% loss of ripe fruit in some fields of Bonny Best tomatoes. It was found only on ripe fruit. The loss for the state was slight." Indiana (Gardner) - "Abundant in canning factory, Marion County, 10-4-22, and in fields. It is a rot of ripe fruit." Kansas (White) - "The disease is present to a slight extent in the tomato project work here. It has not been observed elsewhere."

Buck-eye rot caused by Phytophthora terrestria Sherbakoff was present at Hazelhurst, Mississippi in June. It was doing slight damage. Indiana (Gardner) - "Serious in greenhouses where it has previously occurred. See Kendrick, James B. Phytophthora rot of tomato, eggplant and pepper. Proc. Ind. Acad. Sci. 1922." Other reference: Bewley, W. Tomato diseases. Jour. Royal Hort. Soc. 47: 169-174. 1922.

Bacterial spot caused by Bacterium vesicatorium Doidge did some damage in Indiana, Michigan and Kansas.

Indiana: Seed disinfection seems to have controlled this disease in the canning crop. Only a very few cases were noted in canning factory belts, Marion County, October 14. (Gardner)

Michigan: At Michigan Agricultural College in Horticultural Department variety test. Found only in Earliana variety; 16 different plantings, all from different seedsmen. May have been controlled by spray or else checked by hot dry weather, but gave no advance in attack after July 18. (Division of Botany)

Kansas: A fruit spot on tomatoes resembling the scab spot described by Gardner and Kendrick appeared in this state for the first time this year, and caused considerable damage. A yellow bacterium was isolated, which is listed temporarily as B. vesicatorium. The description of the disease as given by Gardner and Kendrick fits the Kansas specimens. Cultures are being sent to Gardner and Kendrick for identification. Material from Cloud and Reno Counties. (White)

Soft rot caused by Oidium oospora lactis Poole was found in Burlington County, New Jersey. This disease was very serious in several fields last year near Riverton. The fungus enters the cracked tomatoes and causes rapid decay. There were very few cracked fruit this year. (Poole, R. F. A new fruit rot of tomatoes. Bot. Gaz. 74: 210-214. 1922.)

Soft rot of fruit caused by Rhizopus spp. was found in New Jersey on green and ripe tomatoes which touched the ground and were shaded. The disease appeared only in Burlington County.

Bacterial soft rot - common and in general the most important fruit rot in Virginia. (Fromme)

Blossom drop (physiological) was observed in West Virginia, Texas, Ohio and Kansas.

West Virginia: More this year than usual. One very severe case observed in Marion County on an unknown variety. (Sherwood)

Ohio: This disease occurs early, chiefly in hot houses but seldom affects more than one cluster set. (Thomas)

Kansas: Reported as being severe in some home gardens but from no large commercial grower. (White)

Fruit spots (cause unknown) were reported from Kansas and Washington.

Sunscald on fruit was severe both in West Virginia and Indiana. It was the result in most cases of plant defoliation due to Septoria blight.

Cat face (malformation or marking of blossom end) of fruit and growth cracks were reported for Indiana by Gardner. There was considerable damage in the canning crop.

Two new diseases of tomato

Ramsey, G. B. Basisporium gallarum Moll. A parasite of the tomato. Bot. Gaz. 74: 325-328. 1922.

Douglas, Bruce. A new Alternaria spot of tomatoes in California. Phytopath. 12: 146-148. March 1922.

General references to tomato diseases

Anon. Wart disease attacking the tomato. Gard. Chron. III, 71: 62. Feb. 11, 1922.

> "Investigations carried out by the United States Department of Agriculture have proved that tomatoes are susceptible to wart disease of potatoes. Out of twenty-eight varieties of tomatoes planted in a wart-infested garden in eastern Pennsylvania, twenty-six sorts were found to be susceptible to the disease."

Anon. Tomato spraying experiments. New Hampshire Sta. Bul. 203. 1922.

____ Ziekten en beschadigingen van tomaten. Versl. en Meded. Plantenziektenk. Dienst Wageningen No. 26: 30. 1922.

Bewley, W. S. Report of the mycologist. Ann. Rep. Exp. & Res. Sta. Nursery & Mark. Gard. Industr. Dev. Soc. 7 (1921): 32-41. 1922. (Leafspot or anthracnose of cucumber, soft rot of the arum, tomato diseases.)

__________ Tomato diseases. Jour. Roy. Hort. Soc. 47: 169-174. September 1922. (Contains accounts of diseases of greenhouse tomatoes as grown in England, with control measures.)

Botany and plant pathology. Pennsylvania Sta. Bul. 170 (1922): 15-19, 19-20.

A winter blight of tomatoes has been described (E.S.R., 38, p. 50). Continued studies have shown the disease is seed borne, and that high humidity and unbalanced nutrition of the host plant favor its incidence. Spraying tomatoes with Bordeaux mixture for the control of Septoria leaf spot resulted in a larger total yield of fruit but not in a greater proportion of ripe fruit, due, in the author's opinion, to the shading effect of the fungicide. Brief notes are given of three bacterial diseases of tomatoes, one caused by an organism closely resembling Aplanobacter michiganense and the others due to Bacterium exitiosum and Bacillus solanacearum. (Abst. Exp. Sta. Rec. 47: Oct. 1922)

Brooks, F. T. and G. O. Searle. An investigation of some tomato diseases. Trans. Brit. Mycol. Soc. 7: 173-197. 1922.

"Various rots of tomato fruits and certain diseases of the stems of tomato plants have been investigated. These fruit rots commonly occur both on imported and upon home-grown fruit, and are caused by several different fungi about the identity of which there has been much uncertainty. The fungi isolated from rotten tomatoes have been compared with authentic cultures of certain presumably identical or closely related fungi from the United States. One of the rots is caused by Phoma destructiva, the British form of which is identical with that from America. Another is produced by a fungus which has hitherto passed in this country under the name of Mycosphaerella citrullina, but which is certainly not identical with the American fungus of that name. The British fungus which has hitherto been mistaken for this and which causes tomato stem "canker" as well as a fruit rot, appears to be identical with Diplodina lycopersici Hollos which name also replaces Phoma lycopersici Cooke. It has been considered advisable to amplify Hollos' description and the fungus is therefore named Diplodina lycopersici (Cooke) Hollos, emend. Brooks & Searle. Another pycnidial fungus, found only once as the cause of tomato rot, is associated with an Alternaria stage, and the name proposed for this fungus is Phoma alternariaceum Brooks & Searle. Finally, various strains of Gloeosporium and Colletotrichum parasitic on tomatoes have been isolated. One of these fungi is identical with the American Colletotrichum phomoides (Sacc.) Chester, and probably all of these forms are thus best grouped.

"The desirability of undertaking cultural studies of fungi belonging to such genera as Phoma, Diplodina, and Colletotrichum as an aid in the diagnosis of species, is emphasized."

Bewley, W. "Sleepy disease" of the tomato. Ann. Appl. Biol. 9: 116-134. June 1922.

Cunningham, G. H. Stem canker. New Zealand Jour. Agr. Jan. 20, 1922.

Dickson, B. T. Diseases of the potato. Sci. Agr. 2. 1922.

"It is interesting to note that the roots of tomato are susceptible to infection by Spongospora subterranea and that galls are formed similar to those on potato roots."

Harvey, R. B. and R. C. Wright. Frost injury to tomatoes. U. S. Dept. Agr. Bul. 1099. Aug. 1922.

Myers, C. E. The development of new varieties of tomatoes. Amer. Seedsm. 4: 13-15, 52, 54. March 1922.

Pape, Heinrich. Sclerotinia libertiana Fuckl. als schädling der tomatenpflanze. Gartenw. 26: 309-312. 1922.

Parker, Theodore, A. R. Long and J. S. Mitchell. Soil sterilization for tomatoes. Fruit Grow. Fruit. Flor. & Mark. Gard. 53: 631-632. April 1922.

________________ A note on soil sterilization for tomatoes. Bul. Bur. Bio-Techn. Murphy & Son 5: 134-142. March 1922.

Pritchard, F. J. and W. S. Porte. Isaria rot of tomato fruits. Phytopath. 12: 167-172. April 1922.

Riker, A. J. Some morphological responses of the host tissues to the crown-gall organism. (Abstract) Phytopath. 13: 43. Jan. 1923.

Schoevers, T. A. C. Bestrijding van tomatenziekten in Engeland. (Controlling tomato disease in England.) Verslag. en Mededeel. Plantenziektenk. Dienst Wageningen 25. 16 p. 1922.

DISEASES OF SWEET POTATO

Sweet potato certification

For some time the Northern growers of white potatoes have had their fields inspected, and the best stock certified. The results have been so satisfactory that a similar service is being put into practice for the Southern sweet potato grower. At the Atlanta meeting of the Agricultural Workers a committee consisting of various state inspectors working in cooperation with the plant pathologists took up a careful consideration of the subject of sweet potato certification with a view to making recommendations for uniform regulations on this subject.

This subject was very carefully considered and the committee expressed its opinions on the subject in the following resolutions:

"(1) Every state should adopt adequate regulations to prevent the shipment of the sweet potato weevil in potatoes or slips.

"(2) We do not think that the time is ripe for the adoption by all states of regulations making compulsory the certification of sweet potatoes or sweet potato slips as to freedom from disease as a condition of their movement interstate.

"(3) We recommend that each state provide a voluntary certification system making it possible for sweet potato growers to buy dependable seed and slips in so far as freedom from all injurious insect pests and diseases are concerned.

"(4) In our opinion a voluntary certification system as is recommended in these resolutions should have as its minimum requirements the following:

A - SEED CERTIFICATION

"(a) There should be at least one field inspection during the growing season, made with a view to detecting stem rot, mosaic and other field diseases. This inspection should be conducted systematically, beginning at one end of the field and working up and down the rows to the other end. NOT LESS than 20 minutes of thorough inspecting should be allowed for each acre.

"(b) The tubers from fields passing the first inspection should be inspected thoroughly for black rot, foot rot and other rots at least once. This inspection should be made after curing and should be delayed as late as possible. Where early inspections are made additional later inspections are desirable. The inspection should have been made so that potatoes have been inspected from every source or from all parts of the field.

"(c) As a safeguard against abuse of the certificate, the certification system should be supplemented by a registration system in which certificate holders be required to register all sales of both certified and uncertified seed made by them. All certified seed must bear a copy of certificate and all uncertified seed should be labeled as such. The registration system can be improved by a system of notifying purchasers of registrations made.

B - SLIP CERTIFICATION

"Slip certificates may be granted to plant growers who will grow nothing but certified slips. This certificate should be granted under the conditions that:

(a) nothing but certified seed be bedded,
(b) the seed be dipped
(c) the seed be bedded in soil which has never been in potatoes before, and that location of the bed be approved,
(d) tools, implements, frames, etc. be disinfected,
(e) the sales of slips be registered the same as is required of certified seed.

"C - As a condition of the issuance of seed or slips certificates an affidavit be executed setting forth the conditions under which the certificate is granted.

"D - All certificate tags be purchased from the inspector and that all of them be accounted for."

Below are given some of the methods of sweet potato certification followed in the various states:

Alabama: "The State Board of Horticulture maintains a free inspection service for sweet potatoes for seed purposes, or sweet potato slips which are to be shipped outside the state. Such shipments must bear the certification tag, which is purchased from the Board. No inspection or certification is required for sales within the state." (L. E. Miles)

Arkansas: Arkansas has a well developed system of inspection and certification. The service is conducted under their rules 45, 46, 47, 48, 50 and 54.

Application for inspection

"Rule 45. Any person growing Irish or sweet potatoes for seed may have such seed inspected by applying to the Chief Inspector on or before March 1 for the inspection of spring grown seed Irish potatoes and on or before July 15 for the inspection of seed sweet potatoes or fall grown seed Irish potatoes. Such application for inspection shall set forth (a) the location of the place where the seed is grown with reference to the direction and distance to the nearest railroad station, (b) the number of acres to be inspected, (c) the varieties of potatoes, (d) the distance between the blocks of growing seed stock and (e) such other information as the Chief Inspector may need in estimating the time required for the inspection."

Fees for inspection

"Rule 46. For the inspection of seed Irish or sweet potatoes as provided in Rule 45 the Chief Inspector shall charge fees as follows:

"(a) A fee of $5.00 to be paid at the time that the application for inspection is made.

"(b) An additional fee of $1.25 per acre, for each acre which it is desired to have certified. The latter fee to be paid before the second inspection is made.

"(c) An additional fee of $5.00 for each extra inspection which may be warranted as a result of the findings of a previous inspection.

"Applicants must furnish the inspector transportation from and to the railway station and facilities for reaching his fields of seed stock.

"Applicants may withdraw their applications for inspection by notifying the Chief Inspector within 15 days after receiving from him the report on the first inspection.

Requirements for certification

"Rule 47. All seed Irish or sweet potatoes for which certificates of inspection is desired must be inspected at least twice. (a) When the seed crop is growing and (b) at digging time, or if the Chief Inspector shall so elect, after the potatoes have been stored. Applicants must have their seed crop in a clean state of cultivation and in such condition otherwise that all plants can be easily seen by the Inspector.

"(c) Upon proper fulfillment by the grower of the seed potatoes of all requirements, prescriptions and conditions set forth in the notices issued said grower by the Chief Inspector, he shall be issued a certificate of inspection in form as hereinafter set forth in the rules of the Board."

Certification of slips

"Rule 48. The Chief Inspector may issue a certificate of inspection covering sweet potato slips to any person who shall grow his sweet potato slips from seed sweet potatoes for which a certificate of inspection was issued under the provision of Rule 46 when such seed sweet potatoes were bedded in accordance with directions furnished by the Board. Applications for a certificate under the provisions of this rule must be made to the Chief Inspector 30 days before the sweet potatoes are to be bedded, and must be accompanied by a fee of $1.00. The sweet potato slip certificate shall be in form as hereinafter set forth in the rules of the Board."

Labelling requirements

"Rule 50. Holders of certificates of inspection granted under the provisions of Rules 47 and 48 of the Board must attach to each carload, sack, hamper, basket or package of sweet or Irish potatoes or sweet potato slips covered by their certificate a tag bearing a copy of said certificate with the fac simile signature of the Chief Inspector. Said tags to be purchased at cost from Chief Inspector."

"Whenever a holder of a certificate of inspection as provided in Rules 46 and 47 shall sell or ship seed sweet or Irish potatoes or sweet potato slips which are not covered by a certificate issued by the Chief Inspector of the Arkansas State Plant Board he shall attach to every carload, sack, hamper, basket or package of such seed sweet or Irish potatoes or sweet potato slips a tag bearing, in letters not less than 1/4 in. high (24 point type), the words "Not Covered by a Certificate of Inspection from the Arkansas State Plant Board."

All sales of seed and slips must be registered

"Rule 54. Every holder of a certificate granted under the provisions of Rule 47 or 48 of the Board must file with the Chief Inspector, at the end of each week, a copy of each sale or disposition of seed or slips made by him during that week.

"Each invoice shall be made out on a separate slip (form to be provided by the Chief Inspector) and shall set forth the following information:

"(a) Name of the certificate holder disposing of the seed or slips.

"(b) Date of disposition or shipment.

"(c) Person to whom the seed or slips are disposed of.

"(d) Number of bushels, or slips, of each variety disposed of.

"(e) If seed is disposed of, whether it is certified or uncertified.

"(f) If certified seed or slips are disposed of, the number of certificate tags used for the sale or shipment must be recorded.

"Holders of certificates must also account for every certificate tag purchased from the Chief Inspector and all unused or defaced tags must be returned to the Chief Inspector at the expiration of the certificate of which the tags bear a copy."

Aside from these rules, suitable blanks, affidavits, tags and posters are supplied. For more detailed information, address George G. Becker, Chief Inspector, Arkansas State Plant Board, Little Rock, Arkansas.

Florida: "For several years the State Plant Board has been inspecting sweet potato fields, banks, beds, etc. to determine whether or not the sweet potato weevil (Cylas formicarius) was present. A very careful survey of the state several years ago disclosed that the weevil was present in several parts of the state. Since then areas have been quarantined and the above mentioned material has not been permitted to be shipped out of the quarantined areas, except under certain conditions, such as: inspection and fumigation.

"Last year the Plant Board made an effort to have the growers in the state have their fields inspected in the fall, to determine whether or not the wilt disease of sweet potatoes was present; another inspection in the banks for the purpose of determining whether or not black rot was present, and a third inspection of the plants in the beds. The growers were not to use any stable manure from stock which had been fed on sweet potato tubers or vines. The seed was to be disinfected in a solution of bichloride of mercury before planting; old frames sprayed with a solution of formaldehyde and the bedding site approved by an inspector of the Plant Board. All this with the idea of issuing to such growers as complied with the above regulations, a certificate to ship certified seed or plants. This plan has not been taken up generally by the growers in the state so far. However, in order to ship plants into the states of Mississippi and South Carolina, these conditions must be complied with, and a few of the growers have had the necessary inspections for this purpose." (A. C. Brown)

Georgia: "The sweet potato regulations of other states, especially Mississippi and South Carolina, force us to use their methods of certification to a very large extent, because most of our growers desire to ship into other states. So far between five and six hundred potato growers have been certified." (Luther Brown)

"1. In order to prevent the introduction and spread of the sweet potato root borer (Cylas formicarius, Oliv.); also the introduction and spread of destructive diseases of the sweet potato, the importation into and movement within the State of Georgia of sweet potato plants, vines, cuttings, draws or slips shall be governed by the following regulations:

"(a) Shipments of articles enumerated in Paragraph 1 originating in other states and consigned to points in Georgia are prohibited unless accompanied by a sweet potato plant certificate issued by the Georgia State Board of Entomology. Certificates will be issued on receipt of certificates of inspection from authorized agents of their respective states.

"(b) Shipments of articles enumerated in Paragraph 1 when originating within Georgia are prohibited unless accompanied by a sweet potato inspection certificate issued by the Georgia State Board of Entomology.

"In order to secure inspections persons, firms, and corporations growing sweet potato plants in a commercial way must register with the Georgia State Board of Entomology and make application for inspection one month previous to bedding their sweet potato tubers. Two inspections will be given, one of tubers before bedding, and a second of the draws while growing on beds. Upon the first inspection, if potatoes are found free from destructive diseases and insects a certificate will be issued to the bedder, together with information in regard to securing official shipping tags.

"Upon a second inspection, if disease shows up in beds, the diseased section will be destroyed or plant beds condemned as a whole, if, in the opinion of the inspector, the disease is beyond eradication by partial destruction of the plant beds.

Maryland: "Owing to the fact that we have no organizations to do the certifying, no seed was actually certified. However, during the season of 1921 the sweet potatoes of six sweet potato growers were found to be practically free from diseases representing 23 acres of Gold Skin, 8 acres of Big Stem, 1/5 acre of Nancy Hall and 1/10 acre of Porto Rico. During 1922 the sweet potatoes of six growers were found to be practically free from diseases representing 57 acres Big Stem, one acre Gold Skin, 1/15 acre Porto Rico and 1/2 acre Nancy Hall. The yield from these plots was approximately 300 bushels per acre. Three inspections were made, two in the field, and one during storage.

"As soon as organizations are formed with authority to certify seed, we expect to work out a system similar to our Irish potato seed work in which we will inspect the fields and seed stock of the growers and recommend it to them for certification if it comes up to the standard agreed upon by us." (Jehle)

Mississippi: "We have decided to show on the reverse side of all tags issued to be used on shipments of sweet potatoes, the exact condition in which potatoes inspected were found. We are showing the exact number of hills of stem rot and the exact percent of black rot present at the time of the storage inspection. We contemplate next season having what will be known as Class A Sweet Potato Growers, and Class B Sweet Potato Growers. Those in the first class will be the ones who have no black rot or stem rot in their potatoes, while Class B will be those having a small amount of either or both of these diseases in their potatoes. A tag is issued for out-state shipments into Mississippi. Tag on plants is same except "Plants" is stamped on it and condition is stated on reverse side of tag.

"Out-state shippers are required to comply with the same requirements as people who sell in this state." (George F. Arnold)

"For several years we have maintained a sweet potato inspection service. This service was inaugurated in order to check the further distribution of stem rot, black rot, and the sweet potato weevil, and to prevent the further introduction of these pests into the state. The results have been as good as we could have hoped for. We are certain that both stem rot and black rot have been greatly reduced.

"We would not, under any circumstances, allow a man whose property is infested with the sweet potato weevil to sell seed sweet potatoes or sweet potato plants. Therefore, we do not have any commercial potato growers in the area that is infested with the sweet potato weevil.

"I believe that the system we follow in this state is very similar to the system in Florida and Arkansas except that we make it compulsory in Mississippi. In the other states, it is entirely a voluntary matter with the growers, and they have to bear the expense of the inspection. In Mississippi the state bears the entire expense of inspection, and every person who raises sweet potatoes for planting purposes, or sweet potato plants is required to have his potatoes inspected, and a sweet potato inspection tag must accompany all sweet potatoes and sweet potato plants that are sold for planting purposes.

"At present our Quarantine Inspector, Mr. George F. Arnold, is handling the sweet potato inspection service." (R. W. Harned)

"In accordance with the provisions of Rule 53B the following requirements must be met by out-state growers in order to qualify as certified growers and obtain permit tags to cover shipments of seed sweet potatoes into Mississippi.

"1. File with the Potato Inspection Department of the State Plant Board, A. & M. College, Mississippi, a certificate from the State Entomologist or other authorized inspection official showing the approximate number of bushels and stating that the grower's seed have been found apparently free of sweet potato weevil. The certificate must show that the potatoes received two inspections as follows:

(a) While growing in the field. (b) While in storage. A statement from the state official must accompany the certificate showing exactly what diseases were found in the field inspection, the percentage or else the number of infected hills must be stated. It must also be explained about the measures undertaken to insure all seed potatoes being free from stem rot, in such cases particularly whether infected hills were dug out and a re-inspection made later. If any black rot was found, the approximate amount must be indicated.

Sweet potato plant certification requirements for Mississippi growers

In accordance with Rule 53A, the movement of sweet potato plants is regulated as follows:

1. Growers must bed nothing but certified seed.
2. The location of the beds must be approved by a State Plant Board inspector, and the beds must be placed on land that has not been planted in potatoes for at least five years. The bed must be made of soil in which sweet potatoes have never before been grown.
3. The seed to be bedded out must be inspected by an Inspector of the State Plant Board and must be hand-culled and then disinfected for ten minutes in a solution of corrosive sublimate, strength one ounce to eight gallons of water, just before being bedded out.
4. If lumber used in the construction of the beds has been previous-

ly used for the same purpose it must be thoroughly disinfected by being allowed to soak in corrosive sublimate solution, strength one ounce to eight gallons of water, for at least thirty minutes.

5. Stable manure that has been subject to infection with black rot and stem rot spores because of feeding sweet potatoes to stock must not be used in plant beds. (This is a very important point.)
6. All tools needed in the construction of plant beds, and which have previously come in contact with materials used in old beds, should be dipped in corrosive sublimate solution and may then be rinsed in water.
7. Beds must be inspected by an Inspector of the Plant Board at least once, and not more than two weeks before plants are to be removed.
8. Certificate tags will not be issued to cover shipments of plants produced in beds that have been found to be generally infected with black rot, stem rot, or other serious diseases.
9. If black rot or stem rot is found in a limited portion of a grower's bed, the infected potatoes and the soil covering them, and the soil and potatoes not less than two feet from the outermost limits of the infection in all directions must be removed from the infected bed under the supervision of an Inspector of the State Plant Board, and the spot from which soil and potatoes were removed thoroughly disinfected with corrosive sublimate solution, strength one ounce to eight gallons of water.
10. Great care should be exercised to prevent disease organisms being carried to the plant beds either on the feet of stock or any persons who may be working around the beds. There is no doubt that black rot and stem rot spores are very often spread from place to place on a property in this manner."

New Jersey: "The certification of sweet potato seed against stem rot, black rot, and scurf diseases was started in Atlantic County, New Jersey, in 1919 as an experiment by the Department of Plant Pathology. Since 1921 the State Department of Agriculture has continued the work successfully.

"The objects of the certification are to prevent further spread of the Fusaria that cause the disease and to aid growers in New Jersey and other states in locating and buying clean seed.

"Seed are certified in Atlantic, Cumberland and Ocean Counties, where the soil is not severely infected with Fusaria fungi that cause the disease. The soils of Camden, Burlington, and Gloucester Counties were so severely infected in some cases 75% or more of the plants became diseased by digging time.....

"Seed certification is voluntary, and inspections have been made free of charge to the grower. It is the plan of the State Department to make the work self supporting in the future by charging a small fee for each acre certified.

Number of growers entered	48
" " " passing certification requirements	44
Acres certified	225.7
Red Jersey	4.25

Yellow Jersey	80.0
Big Stem Jersey	40.0
Miscellaneous	.95
Acres entered	254

Requirements and rules for the inspection and certification of New Jersey seed sweet potatoes as adopted by the New Jersey State Department of Agriculture

- - - - - - - -

1. Application for inspection and certification must be made on prescribed blanks not later than June 1.
   (The grower has the privilege of increasing or decreasing the acreage by filing notice with the Bureau of Statistics and Inspection, Department of Agriculture, not later than the date of the first inspection.)
2. The application must be made to the Chief of the Bureau of Statistics and Inspection.
3. The applicant must pay fees as follows:
   Two dollars ($2.00) per acre for the first five acres.
   One dollar ($1.00) per acre for each additional acre.
   If the acreage is less than five, the minimum fee will be ten dollars ($10.00).
4. The fee must accompany the application.
5. The applicant must sign an agreement to comply with all the rules and regulations for inspection and certification prescribed by the State Department of Agriculture.
6. Fields entered for certification must be planted with slips from seed treated before bedding.
7. The inspector will make three inspections:
   (a) The first inspection about July 15 to August 1.
   (b) The second inspection just previous to digging and before frost. The inspector may require the digging of some hills at this time.
   (c) The third inspection about November 15 to December 1.
8. Crops will be disqualified for more than 4 percent of black rot or 5 percent of stem wilt, or for a total of 7 percent diseased of the two. Seven percent of disease at time of the first or second inspection or a total of 7 percent for the two inspections, will disqualify the field, and the third inspection will not be made. Ten per cent of scurf will disqualify the field.
9. The crop must be marketed in standard bushel hampers and each hamper must carry the prescribed tag.
10. The tags must not be used on any potatoes other than those that have been passed and certified.
11. If the field passes all inspections, the grower will be given a certificate.
    Note: The certificate and tags refer only to the condition of the potatoes at time of last inspection and have no bearing whatever on rots and other undesirable conditions that may develop following that time."

South Carolina: "We have for the past several years attempted to make careful inspections of sweet potatoes both in the field and in storage, and have only permitted the sale of seed potatoes and plants where the stock is found free from disease. We have permitted a small percentage of black rot and scurf, but have endeavored to prevent the sale of stock for seed in all cases where any other diseases are present. The Crop Pest Act of this state gives the Crop Pest Commission power to make regulations which prohibit the sale and transportation of sweet potatoes for planting unless they have been inspected by our agent and found free from disease, in which case shipping tags are issued. Our regulations with reference to sweet potatoes require that the potatoes shall be inspected in the field before frost, must be inspected in storage, and the beds must be inspected before the first crop of plants is removed." (H. W. Barre)

Tennessee: (Certification of sweet potato seed)

Section 1. ALL REQUESTS for INSPECTION must be filed in the Office of the State Entomologist ON OR BEFORE MARCH 1st. of EACH YEAR. Inspections will be made ONLY UPON WRITTEN REQUESTS.

Section 2. For bedding purposes one must use certified seed.

Section 3. All seed used for bedding stock must be culled and disinfected with a solution of corrosive sublimate. Sanitary precautions must be taken about the beds and premises.

Section 4. Sweet potatoes intended for certification must be grown in a field where no sweet potatoes were grown during the preceding three years and should not be located immediately below another field contaminated with disease during the same period, three years.

Section 5. The potatoes must be stored in houses thoroughly cleaned and disinfected.

Section 6. Every holder of the certificate must tag every package or container, irrespective of size, with a certificate tag of inspection. The use of each tag must be reported to the Office daily.

In every case where a requirement cannot be ascertained by inspection as in the case of Section 4 a sworn statement from the seed or slip producer or dealer of the same shall be required.

Inspections

For the present the inspections for certifying seed and slips shall be as follows. It shall be in the power of the inspector to make any additional inspections he deems necessary.

1. Of all plant beds in the spring from the beginning to the end of removing of the draws or slips. This is primarily to detect disease affected slips or draws.

2. Of the fields during the growing season previous to September 1. This is to detect field diseases, chiefly stem rot and foot rot.

3. During digging time. This is done chiefly to detect black rot, stem rot and foot rot.

4. Of the potato seed (at least 1% must be seen) in the storage house after January 1. This inspection is primarily for black rot.

Virginia: The first work done with the certification of sweet potatoes in Virginia was begun when I took charge of the vegetable work in July 1921. During the season of 1921 approximately fifty fields were inspected and a large percentage of these received certificates for their stock. Since that time the work has developed steadily and at the present time we have certified sweet potatoes being produced in approximately twelve counties in the eastern part of the state. Most of this work is still confined to certain communities where we have endeavored to keep the work under close supervision in order to guard against possible trouble as a result of insufficient inspection. (A. G. Smith, Jr.)

General rules governing the certification of sweet potatoes

1. Growers desiring to produce certified potatoes must apply to the State Crop Pest Commission on or before February 1st of each year. An application blank will be furnished upon request.

2. There is no cost for inspection, but the growers will be requested to furnish transportation of the inspector to and from the nearest railroad station, or hotel, to the sweet potato fields.

3. It is recommended that all growers of certified sweet potatoes use certified seed exclusively. If certified seed are used it will be necessary for the growers to disinfect and bed them as directed by the inspector.

In case the grower does not have certified seed, he may select clean potatoes from his stock under the direction of the inspector and disinfect and bed them as for certified seed. If no disease appears during the growing and storage seasons, the grower may have his crop certified.

4. Any grower who wishes to purchase plants (draws) for the production of certified sweet potatoes, will be required to use plants from certified seed only.

5. All plantings listed for certification shall be made on land where sweet potatoes have not been grown for the preceding three years.

6. All fields listed for certification shall be inspected by an authorized representative of the State Crop Pest Commission at least twice during the growing season. The dates of the inspection to be determined by the Crop Pest Commission.

7. If the grower is producing both certified and uncertified sweet potatoes, the two crops shall be handled separately.

8. All sweet potatoes to be certified shall be harvested before the leaves are injured by frost.

9. Sweet potatoes that are to be certified shall be stored in a house approved by the inspector. Potatoes stored in banks will not be certified.

10. Certified sweet potatoes shall be graded into U. S. grade number 1 and U. S. grade number 2 at time of harvest.

11. At least two storage inspections shall be made. Additional inspections may be made if conditions justify.

12. The presence of destructive diseases or insect pests in the seed bed, field, or storage house may render the sweet potato ineligible for certification.

13. No mixing of varieties in the same container or bin will be permitted where the stock is to be certified.

14. In order to make it possible for the Crop Pest Commission to follow the shipments of certified seed stock from point to point, and maintain a high standard for certified sweet potatoes, every holder of a certificate will be required to comply with the

following regulations:

(a) Each container shall be plainly marked at time of harvest with a number or initial of the grower, and this number or initial is to be registered with the Crop Pest Commission.

(b) Holders of seed potato or plant (draw) certificates issued by the State Crop Pest Commission will bear in mind that they are required to label every shipment or sale of their seed potatoes or plants (draws) regardless of whether they are certified or not. A tag must be attached to each car load, sack, crate, hamper, basket or package of seed sweet potatoes or sweet potato plants (draws) covered by their certificate, bearing a copy of said certificate with a fac simile signature of the State Entomologist.

Whenever a holder of a certificate of inspection shall sell or ship seed sweet potatoes or sweet potato plants (draws) which are not covered by a certificate issued by the State Crop Pest Commission, he shall attach to every car load, sack, crate, hamper or package of such seed sweet potatoes or plants, a tag bearing (in letters not less than 1/4 inch high, 24 point type) the words "Not Covered by a Certificate of Inspection from the State Crop Pest Commission."

Certification work has not yet been begun in Louisiana, Texas, and North Carolina.

References

Becker, G. G. Sweet potato certification in Arkansas. Quart. Bul. St. Pl. Bd. Florida 6: 61-70. April 1922.

Bentley, G. M. and H. L. Fackler. Sweet potato certification. Tennessee State Board of Entomology Bul. 37: 1-8. 1921.

Reed, W. V. Rules and regulations governing the transportation and movement of sweet potato plants, vines, cuttings, etc., into and within the state of Georgia. Georgia State Board of Entomology Press Bul. 8: 1921.

State Plant Board. Sweet and Irish Potato Inspection Service. Arkansas State Plant Board Circ. 9: 1-12. 1920.

DISEASES

Stem rot caused by *Fusarium batatatis* Woll. & *F. hyperoxysporum* Woll.

Stem rot was present in every state where sweet potatoes are grown, and in at least half of them it was one of the major troubles. The disease was fairly uniformly distributed, although it was more serious in some areas than others. Poole in New Jersey stated that in Burlington, Gloucester and Camden Counties it was more prevalent than in Ocean, Atlantic, Mercer, Salem and Monmouth Counties.

Dates of earliest appearance have been submitted as follows: April, New Jersey; July 28, Prosperity, South Carolina; July, Wiggins, Mississippi; July 3 at Mill Spring, Missouri; June 12 at Wyandotte, Kansas; and August 1 in Warren County, Ohio.

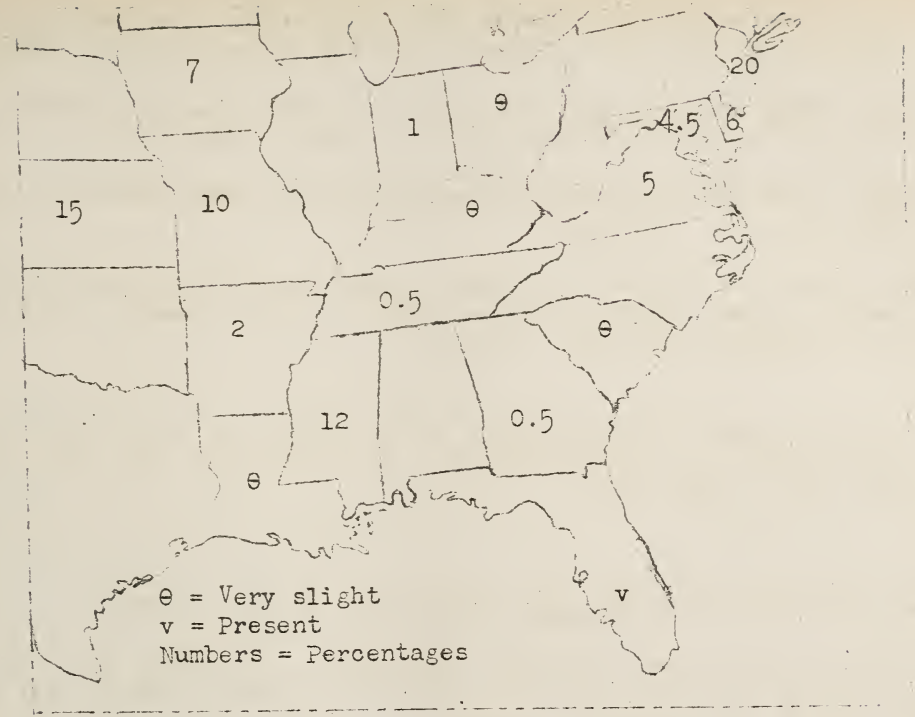


Fig. 7. Distribution and prevalence of stem rot in 1922.

(See also Plant Disease Bulletin 6: 91, 113, 151. 1922)

Varietal susceptibility

Sweet potatoes offer another possibility for selection of resistant varieties. The principal difficulty is that they blossom so sparingly that cross breeding of susceptible commercial varieties with resistant non-commercial ones is beset with many problems. Improvement must be made in great part by selection within the variety.

New Jersey: The yellow Jersey variety is most susceptible. Porto Rico, Nancy Hall and Red Jersey are also very susceptible. The big stem Jersey strains are more resistant than any of the above varieties. Triumph has been 100% resistant under two years' testing. The Dooley or Norton yam variety is also very resistant. (Poole)

Missouri: Important varieties in order of susceptibility approximately: Nancy Hall, Jersey, Nansemond, Porto Rico. (Page)

Kansas: Porto Rico shows marked resistance, but is not immune. (Stokdyk)

Control measures

Hill selection and propagation by cuttings from young healthy plants have proved popular in many of the states.

New Jersey: Slight reduction of percentage of disease has been obtained by seed selection for freedom from the disease. Progress is being made in the study of fertilizer relation to the disease. (Poole)

Arkansas: Seed and slip certification has helped reduce the spread of the disease, and emphasized its importance. (Elliott)

Missouri: Attempts to control by seed selection, seed certification and orop rotation. (Maneval)

Kansas: Severe in some lots of seed. Many plants show infection but perfect roots. Hill selection reduced disease greatly. Growers are beginning selection. (Stokdyk)

Reference

Poole, R. F. Recent investigations on the control of three important field diseases of sweet potatoes. New Jersey Agr. Exp. Sta. Bul. 365: 39 p. April 1922.

Black rot caused by Sphaeronema fimbriatum (E. & H.) Sacc.

Black rot, as usual, was generally distributed. It seemed to be most prevalent in Kentucky and Tennessee. In some states careful control measures are generally reducing the amount of injury.

New Jersey: Common in many localities in field spreading seriously in some storage houses. It was found on Yellow Jersey, Red Jersey, Big Stem Jersey, Gold Skin, Nancy Hall, and Porto Rico varieties. (Poole)

Delaware: Wire worm injury appeared to account for considerable infection. (Adams) (See also under soft rot)

Virginia: General in seed potatoes in Norfolk and James City Counties. (Fromme)

South Carolina: Practically all county agents reporting record of this disease. (Ludwig)

Mississippi: Still general but becoming less. (Neal)

Arkansas: Fairly bad in storage, but less complaint than last year. (Elliott)

Table 29. Prevalence of, and losses from black rot in 1922.

State	% loss	State	% loss	State	% loss
New Jersey	2	South Carolina	.5	Texas	3
Delaware	.5	Georgia	2	Indiana	Trace
Maryland	1	Florida	Present	Illinois	General
Virginia	5	Mississippi	5	Iowa	5
Kentucky	15	Louisiana	1	Kansas	2
Tennessee	10	Arkansas	1	Arizona	Trace

Control measures

Seed selection, seed treatment and the use of certified seed are gradually decreasing the ravages of the fungus.

Kentucky: Seed treatment for black rot control (Mercuric chloride) was tried on 127 farms this year. The results are promising. (J. S. Gardner)

Tennessee: General in all beds in southwestern Tennessee where certified seed not used. In cases where certified seed used, beds free from black rot. (Hesler)

Kansas: Seed selection and seed treatment are controlling it satisfactorily. (Stokdyk)

References

An interesting piece of work done by J. A. Elliott was reported at the Boston Scientific Meeting.

Elliott, John A. The ascigerous stage of the sweet potato black-rot fungus. (Abstract) Phytopath. 13: 56. Jan. 1923.

> "Examination of embedded and sectioned material has shown that the supposed pycnospores are ascospores which are apparently liberated within the perithecium by the early disintegration of the ascus......The taxonomic characters place the fungus in the genus Ceratostomella and the specific name, *C. fimbriata* comb. nov. is therefore proposed for it."

Soft rot caused by *Rhizopus* spp.

Soft rot occurs wherever sweet potatoes are found, but collaborators are hesitant about trying to estimate the depreciation in value of the tubers. No doubt the losses are very large, particularly in storage and in markets. The rot is most often associated with some other form of injury. Judging from reports it is much easier to grow sweet potatoes than it is to keep them healthy after they are grown. The following states give actual percentages of injury for 1922: New Jersey, 8.5%; Texas. 10%; Arkansas, 8%; Illinois, 1%; and Iowa, 20%. Other states reporting the presence of the disease are Delaware, Virginia, South Carolina, Florida, and Kansas.

New Jersey: Serious in some houses where curing was poorly done. Rats and mice were important in many houses causing much injury. The injured potatoes finally rotted due to infection by *Rhizopus* spp. (Poole)

Delaware: This year has been characterized with the greatest loss in sweet potato storage that has occurred to our knowledge in the last decade, and possibly in the history of this crop in Delaware.

The rots occurring are the result of the soft rot organism, *Rhizopus* sp. and the black rot, *Sphaeronema fimbriatum*. The soft rot is most prevalent and will probably account for 30% loss in the storage of sweet potatoes this year. The black rot will account for a 10% loss of sweet potatoes in storage. One of our growers in the largest producing center states that soft rot will run about 30% and black rot 15%. Others report soft rot ranging from 20 to 30% and black rot 5 to 15%. In one instance 1500 baskets of stored sweet potatoes packed 210 hampers, when under normal conditions about 750 hampers should have been packed. This extreme loss is associated with various causes. The following explanations have been offered by growers.

1. Owing to the large crop the storage houses were over loaded, which prevented normal control of the moisture and temperature conditions.

2. There is a prevalent opinion that sweet potatoes were harvested and stored before they were mature. Many consider also that they contained excess moisture.

3. The failure to secure coal in many sections was an important factor, as it was impossible to maintain proper temperature conditions with the use of wood fires.

4. The majority of growers associate the excessive use of potash in their fertilizer applications. It is of further interest along this line that the fertilizer men observe in the orders being placed for sweet potato fertilizers that the amount of potash requested is much smaller than has been used in the past few years. (Adams)

Maryland: Heavy losses in storage houses of eastern Maryland due to overcrowding of the houses. (Jehle, March 1923)

Virginia: Losses in home storage in James City and Norfolk Counties ranged from 15-30%. (Fromme)

South Carolina: Tisdale reported loss in a few houses, ranging up to 3%; higher in some banks. Sometimes associated with black rot. (Ludwig)

Kansas: Present in most fields on potatoes that were injured by gophers. (Stokdyk)

Table 30. Prevalence of Rhizopus rot in car load lots of inspected sweet potatoes.

Origin of shipment	No. carloads inspected	Approx. av. % rot	Origin of shipment	No. carloads inspected	Approx. Av. % rot
New Jersey	8	5.6+	Georgia	3	14
Delaware	4	42.5	Tennessee	2	13.5
Maryland	3	12 +	North Carolina	1	6
Virginia	4	5.8+	Alabama	2	1+

A number of other fungi besides Rhizopus cause storage rots of sweet potatoes. In some of the reports the percentage of rot for all these organisms is included in one estimate.

Table 31. Estimated percentages of rot of sweet potatoes caused by all organisms.

State	% loss	State	% loss	State	% loss
Virginia	20	Illinois	1	Tennessee	3
South Carolina	2	Iowa	20	Mississippi	20
Georgia	10	Kansas	2	Louisiana	15
Indiana	4	Kentucky	50	Arkansas	12

According to Neal, storage rots are still very important in Mississippi, but the losses are becoming less where good storage house management is followed.

According to Lauritzen and Harter (1) there is a relation of humidity to the infection of sweet potatoes by Rhizopus.

> "Only a small percentage of potatoes halved with a knife became infected with Rhizopus when subject to relative humidities of 94 to 98% at temperatures 22.5 to 24°C.
>
> "The percentage of infection increases as the humidity is lowered until at a relative humidity of 72 to 84% it is nearly 100.
>
> "At relative humidities of 59 to 63% there is decrease in the percentage of infection and at 49 to 52% it is about 20.
>
> "At a temperature of 12°C the relation of humidity to infection is the same as at 22.5 to 25°C except that the range is narrower.
>
> "If potatoes subjected to humidities of 94% at 22.5 to 25°C are exposed to lower humidities, scarcely any infection occurs, but if potatoes subjected to humidities of 49 to 63 are placed at the same humidities nearly all become infected.
>
> "Apparently changes take place at the higher humidities which make the potatoes more resistant to the attack of Rhizopus. This resistance seems to be located in the outer cells of the cut surface, because if a thin slice is cut off from the potatoes parallel to the cut surface, these potatoes become infected."

References

(1) Lauritzen, J. I. and L. L. Harter. The relation of humidity to the infection of sweet potatoes by Rhizopus. Phytopath. 13: 56. 1923.

(Not cited)

Harter, L. L. and J. L. Weimer. Susceptibility of the different varieties of sweet potatoes to decay by Rhizopus nigricans and Rhizopus tritici. Jour. Agr. Res. 22: 511-515. November 26, 1921. (April 1922)

Foot rot caused by Plenodomus destruens Harter

Foot rot is limited in its distribution, and no more than a trace of loss is accredited to it. The following states record it: New Jersey (slight loss in Vineland section and in Toms River vicinity), Maryland (trace, southeastern part of state), South Carolina (trace), and Kansas (here and there a trace). It was not observed in Mississippi, Iowa, Louisiana, and Arkansas. The date of earliest appearance is given as July at Vineland, New Jersey.

Pox or soil rot caused by Cystospora batata Elliott

Pox or soil rot has been known to cause much damage in individual fields but the losses in none of the states are high. The disease was found in the following nine states: New Jersey (.6% loss), Delaware (1.5%), Maryland (.5%), Mississippi (trace), Texas (1%), Kansas (2%), Virginia (trace), Louisiana (trace) and Arkansas (trace). It was reported as not present in Kentucky. Dates of first appearance: New Jersey, May in Gloucester County; Delaware, August 9 at Houston; and Kansas, September 12 at Riley.

Control measures

According to Poole in New Jersey "Progress has been made (in the control of pox) in treating soil with inoculated sulfur. Broadcasting 300 to 400 pounds just previous to making up ridges has given best results. From 4 to 5% nitrogen is advised for infected soils, where 2% is ordinarily used." Stokdyk in Kansas says pox is "on the increase in old fields where no control measures are practiced."

Scurf caused by Monilochaetes infuscans Hals.

Scurf is a widely distributed disease of sweet potatoes. Fortunately it has not reduced the crop or the salability of it to any great extent. Eleven states report its presence: Delaware (common), West Virginia (one case seen), New Jersey (1%), Maryland (.5%), South Carolina (trace), Florida (present), Mississippi (2%), Louisiana (slight), Arkansas (trace), Kansas (present), and Arizona (1%).

There is a slight difference in the susceptibility of varieties, but none of them are nearly enough resistant to be advocated as the varieties to use.

New Jersey: Serious and widely distributed in the state. It has been observed on all varieties grown in this state. Very serious on Nancy Hall. (Poole)

Delaware: The most commonly distributed disease affecting the roots. The disease was very severe where heavy applications of manure are used. (Adams)

Mississippi: Appears worse on the white skinned varieties. (Neal)

Control measures

Seed treatment and the application of inoculated sulfur are recommended.

New Jersey: Splendid control has been obtained on some soils by applying 300 lbs. inoculated sulfur. (Poole)

Delaware: Inoculated sulphur in experiments conducted this season have given practical control when used at the rate of 200-400 lbs. per acre. (Adams)

Arkansas: All varieties; seed treatment gives control. (Elliott)

Kansas: Treated seed free from the disease. (Stokdyk)

Miscellaneous tuber rots and injuries

Surface rot caused by Fusarium oxysporum Schlecht. has been reported from New Jersey by R. F. Poole who adds that "It is serious in some storage houses. All varieties grown in the state are attacked. Infection probably takes place in storage."

> "According to L. L. Harter and J. L. Weimer (Bur. Markets & Crop Est. Fruit & Veg. Div. Letter 3: after p. 73. March 9, 1922) who have made a thorough study of this rot, it occurs wherever the crop is grown. The loss varies in different years. In some houses where conditions are favorable for the disease the loss might run as high as 25%. Varieties vary in susceptibility; both Big Stem Jersey and Little Stem Jersey are readily attacked by the disease.
>
> "Infection takes place at digging time or a little before it, or early in the storage period, although the disease is not conspicuous until two weeks to six months after the potatoes have been in storage. The disease is caused by the organism Fusarium oxysporum.
>
> "When possible the potatoes should be harvested during dry weather and allowed to dry in the sun for a few hours before going into the storage house. Furthermore, the storage house should be warm and dry when the potatoes are put in, so that curing will begin promptly. This is especially desirable if the potatoes are dug from a wet soil during cloudy weather."

Charcoal rot caused by Sclerotium bataticola Taub. was reported from New Jersey, Texas and Louisiana. Poole (New Jersey) writes that "The disease causes no serious damage in this state. It has been found in storage houses in various counties. It is sometimes seen in the field on potatoes left on the ground after the crop has been harvested." In Texas it caused 1% loss, according to Taubenhaus.

Rot caused by Trichoderma koningi Oud. did some injury in storage in New Jersey.

Java black rot caused by Diplodia tubericola (E. & E.) Taub. was found in South Carolina (northeastern part of state, unimportant), Louisiana (very common, loss 2-4%), Texas (trace), and Florida.

Dry rot caused by Diaporthe batatatis Harter and Field was reported by L. E. Tisdale, crop pest commission inspector, as being present in one storage house last spring. (Ludwig - South Carolina)

Soft rot caused by Botrytis vulgaris Fr. attacked plants in hot beds and potatoes in storage, according to R. F. Poole (New Jersey). The disease was observed on all varieties grown in the state.

Tuber injuries (non-parasitic). Pithiness of stored roots was reported by Ludwig from South Carolina. Taubenhaus describes a hollowheart:

> "During 1917 and 1918, the writer received a large number of specimens of sweet potatoes which when broken open showed a hollow area in the interior of the sweet

> potato root. Cultures of the tissue yielded no organism. It seems that this condition was brought about by the extreme dry weather during the summers of 1917 and 1918, and this was further aggravated by the regular period of curing or sweating which these potatoes underwent in storage."

Dana of Washington found *blackheart* in market sweet potatoes.

Other diseases

White rust caused by *Albugo ipomoeae-panduranae* (Schw.) Swingle was observed in Delaware, South Carolina, Louisiana, Florida and Kansas. The loss was almost negligible except in Delaware where, according to Adams, it was more prevalent than usual, the mature spots on older leaves falling out and producing a shot-hole appearance. The dates of earliest appearance were in Delaware, July at Seaford; Illinois, July 31 at Cave-in-Rock; Louisiana in August; and at Clemson College, South Carolina, August 25.

Leaf spot caused by *Phyllosticta batata* Cke. was found in New Jersey, South Carolina, and Florida. There was no reduction in yield. Poole of New Jersey writes that leaf spot was observed on all Jersey grown varieties. In South Carolina it was first seen at Clemson College August 25 and during the same month in Gloucester County, New Jersey.

Leaf spot caused by *Septoria bataticola* Taub. was generally prevalent in New Jersey and Delaware although no injury to the crop was reported. R. F. Poole of New Jersey submitted the following information: "Slight variation noted in varietal susceptibility. The Jersey varieties are susceptible. The Dahomey, White Yam, Red Brazil and Triumph were somewhat more resistant."

Mosaic was found in Arkansas on the Nancy Hall variety and in Tennessee. Apparently no loss was sustained. (See Weber, Geo. F. Mosaic disease of sweet potato. (Abstract) Phytopath. 13: 42-43. Jan. 1923.

Foot rot caused by *Macrosporium solani* E. & M. reported as follows by Taubenhaus in Texas:

> "This disease was found in cold frames of tomato plants and in sweet potato beds in east Texas. It is similar to the one described by Rosenbaum and Pritchard on the tomato. From isolation and infection studies of the Texas material, it was found that *Macrosporium solani* was the only organism present in both the sweet potato and tomato material. Little difficulty was experienced in infecting healthy plants of both hosts with this fungus."

Texas root rot caused by *Ozonium omnivorum* Shear again was very serious in Texas, where Taubenhaus estimates that 6% loss was caused. J. G. Brown (Arizona) says, "Found in Salt River and Santa Cruz Valleys. From the former, George reports a reduction in yield amounting to 50%."

Sclerotium wilt caused by *Sclerotium rolfsii* Sacc. was reported from Louisiana (common in seed beds, loss slight, earliest appearance April 21) and South Carolina (seriousness increased by fact that in most instances disease occurred in plant beds).

Root knot caused by *Heterodera radicicola* (Greef) Müll. resulted in 3% loss in Arkansas (Elliott) - "There was a dwarfing of plants in the field and distortion of the roots. One peculiarity noted in a badly infected field was that all the badly injured plants blossomed profusely."

A slime mold, Fuligo violaceae, was reported by Poole from New Jersey. It was seen in April and May on all local varieties and caused a stunting of the plants.

Chlorosis was mentioned by Taubenhaus of Texas. He suggests that an over supply of lime may be the cause.

General references on sweet potato diseases, etc.

Becker, Geo. G. Three years sweet potato certification work in Arkansas. (Abstract) Phytopath. 12: 252. May 1922.

Burger, O. F. and A. C. Brown. Some sweet potato diseases. Quart. Bul. State Plant Bd. Florida 6: 71-76. Apr. 1922.

Gardner, W. A. Notes on the physiology of the sweet potato. (Abstract) Phytopath. 12: 251. May 1922.

Harter, L. L. Field and storage diseases of the sweet potato and their control. Sweet Potato Bul. 27: 10-12. May 1922.

____________ Field and storage diseases of the sweet potato and their control. (Abstract) Phytopath. 12: 251. May 1922.

Manns, T. F. Diseases of the sweet potato. Trans. Penin. Hort. Soc. 35 (1921): 132-136. 1922.

Poole, R. F. Recent investigations on the control of three important field diseases of sweet potatoes. New Jersey Agr. Exp. Sta. Bul. 365: 5-39. 1922.

> The results are given of studies on the control of yellows or stem rot of sweet potatoes due to Fusarium batatatis and F. hyperoxysporum, ground rot or "pox" (Cystospora batata), and scurf or soil stain (Monilochaetes infuscans).

____________ Sweet potato diseases in New Jersey. New Jersey Agr. Exp. Sta. Circ. 141: 3-31. Sept. 1922.

Thompson, H. C. and J. H. Beattie. Sweet potato storage studies. U. S. Dept. Agr. Bul. 1063: 1-18. May 1922.

Thompson, H. C. and J. H. Beattie. Group classification and varietal descriptions of American varieties of sweet potato. U. S. Dept. Agr. Bul. 1021: 1-29. Apr. 1922.

BEAN

Bacterial blight caused by Bacterium phaseoli EFS

Bacterial blight continues to be one of the most destructive diseases of the bean. It is prevalent in nearly every state where beans are grown, and attacks almost all of the commercial varieties.

Vermont: I have just returned from a two weeks' trip inspecting bean fields in New York and Vermont. Bacterial blight is generally prevalent but as yet doing little harm to the main field crops. With favorable weather for its spread serious losses, especially in

Red Kidney sections, may again be expected this year. Many fields of early garden and canning varieties grown for seed have already been reduced in yield of marketable product from 10-50% because of blight. (R. D. Rands, August 17)

Bean anthracnose and bean blight are much above normal, due undoubtedly to late June and early July infections. (Lutman)

New York: (Genesee County) - Bacterial blight is showing up very commonly now. (L. C. Tyler, N. Y. St. Coll. Agr. Dept. Pl. Path. & Ent. Weekly News Letter, August 7, 1922.)

North Dakota: This disease rarely found in state, except in certain years, when a few plots are often severely infected. (Wanda Weniger)

Arizona: Disease most destructive for years, due to poor seed and weather conditions favoring disease. George reports 10% loss in Navajo and Apache Counties. (Brown)

(See also Plant Disease Bulletin 6: 61, 125, 126, 136. 1922)

Table 32. General prevalence of, and losses from, bacterial blight of beans in 1922, according to reports of collaborators.

State	Prevalence compared with		Importance or Estimated % loss
	Last Year	Average Year	
New Hampshire			Present
Vermont			10
Massachusetts		Same	1
Connecticut			3
New York			3-5
Pennsylvania			4
Delaware	More	More	1
Maryland	More	More	1.5
Virginia			Trace
West Virginia	Less	Same	Trace
Kentucky			General
Tennessee			2
South Carolina	Same		2
Georgia	Same		1
Florida			Considerable
Mississippi	Same	Same	3
Louisiana	Same		3
Texas			Trace
Oklahoma			On late crop
Chio	Less	Less	2
Indiana	Less	Less	2
Illinois	Same	Same	Trace
Michigan			General
Wisconsin	Same	Same	1
Minnesota	Same	Same	2
Iowa	Same	Same	2.5
North Dakota			0
Colorado			Present
Arizona			1
Idaho			0
Washington			0
Oregon			Present

The weather conditions evidently play a large part in determining the seriousness of the disease. In Massachusetts where there was a loss of 10% the disease was given its impetus by a very wet June. In Maryland where the summer was wet, blight caused greater loss than for the average year. In Indiana and Michigan later drouths checked the progress of the organism, so that the reduction in crop was less than usual.

Table 33. Earliest appearance of bacterial blight in 1922.

Date	Place	Date	Place
April 25	Hammon, Louisiana	July 1	Madison, Wisconsin
May	Mississippi	July 2	Ramsey County, Minnesota
June 17	Stratham, New Hampshire	July 20	New Haven, Connecticut
June 19	New Castle, Delaware	July	Wayne County, Ohio
June 22	Jefferson County, Illinois	August 15	Massachusetts

Beans lend themselves readily to cross breeding, and much work is being done with the object of developing varieties resistant to the different diseases. Unfortunately, no great progress has been made thus far in the procuring of blight-resistant strains. Inasmuch as this is one of the serious troubles of beans, and the planting of immune varieties the only practical method of control, it is hoped that such a possibility will soon be realized.

References

Gloyer, W. O. Bacterial blight of beans under field conditions. (Abstract) Absts. Bact. 6: 40. 1922.

Anthracnose caused by Colletotrichum lindemuthianum (Sacc. & Magn.) Br. & Cav.

Anthracnose is still one of the important bean diseases, even thouch considerable progress has been made toward its elimination by means of resistant varieties. The average losses according to all the reports were about 3% for 1922. This is not accurate since each state reporting does not have the same acreage of beans, thus the loss for the United States was probably even larger than that indicated.

Vermont: I have just returned from a two weeks' trip inspecting bean fields in New York and Vermont.......Here also anthracnose was occasionally observed, but rare in dry shell varieties. (R. D. Rands, Aug. 17)

South Carolina: Reported by county agents and probably correctly so from Charleston and Georgetown Counties, but we have no positively authentic records. (Ludwig)

Mississippi: The disease is widespread this season, particularly in the southern trucking sections of the state. Reported from Pearl River, Stone, Harrison, Jackson, Lamar, George, Clarke, Copiah, Marion, and Hinds counties. It has resulted in serious loss in several instances, many five and ten acre fields being damaged as much as 75%. W. L. Blain, Pathological Inspector, State Plant Board, reports a complete loss of five acres in Harrison County because of the disease. No doubt scattered everywhere by infected seed. Why not pass a federal seed inspection law? This would prohibit seed dealers from selling infected seed such as bean anthracnose, which is easily discernible. It's a crime for a grower to pay $12.00 a bushel for bean seed from a dealer, put in his labor, fertilizer, and then have a total loss from anthracnose. This is what has happened all over the state this season - the growers have purchased anthracnose infected seed the bulk of which comes from Michigan and New York state. We will have to put on a home grown seed program down here unless the northern growers can supply anthracnose free seed. It has certainly wrought havoc this season. (D. C. Neal)

Louisiana: Infection scattering. A few fields were a total loss but in most fields there was but little anthracnose. (Edgerton)

(See also Plant Disease Bulletin 6: 61, 93, 126, 136. 1922)

Table 34. Prevalence and losses from bean anthracnose in 1922, as estimated by collaborators.

State	Prevalence compared with		Estimated percent loss	State	Prevalence compared with		Estimated percent loss
	Last Year	Average Year			Last Year	Average Year	
New Hampshire	Worse	Worse	25	New Jersey			Present
Vermont			5	Pennsylvania			6
Massachusetts		Same	3	Delaware			.5
Connecticut			1	Maryland	Same	Same	
New York	More	Less	1-3	West Virginia	Same	Same	4
Tennessee			2	Wisconsin	Less	Less	1
South Carolina			Trace	Minnesota	More	Same	Trace
Georgia	Less		1	Iowa	Same	Same	.5
Florida			Present	North Dakota	Less	Less	Trace
Mississippi	More	More	5	Missouri			3
Louisiana	Same	Less	1	Colorado	Same		
Arkansas			Present	Oregon			Present
Ohio	Same	Less	4	Idaho			0
Illinois	Less	Less	Trace	Washington			0
Michigan			Present				

The nature of the discharge of the spores of Colletotrichum necessitates the presence of moisture for their dissemination, consequently the spread and severity of the organism are dependent entirely upon weather conditions.

Vermont: The outstanding weather conditions for Vermont were: a very wet June, the wettest on record for this region, with a normal temperature; a rather dry and warm July, but with enough rain to prevent the soil from ever becoming really dried out; and a normal August and September both as to rainfall and temperature. The very cool nights, all summer, have been another peculiar feature of the summer of 1922.

......The bean anthracnose and bean blight are much above normal due undoubtedly to late June and early July infections. (Lutman)

Control measures

The only practical method of control is in the use of resistant varieties. A number of such varieties are now being put on the market, so that the prediction seems justified that in the not too distant future all snap and dry beans will be of this sort.

New York: Nearly all dry beans now grown in the state are resistant or at least partially resistant to anthracnose so that the loss has been reduced very much. (Chupp)

Mississippi: The green snaps and green bush varieties are, as a rule, resistant, whereas the bush wax sorts are very susceptible. (Neal)

Wisconsin: In test fields of Everett B. Clark Seed Company, Marshall, on September 1 noted French Horticultural highly resistant and Dwarf Horticultural heavily infected. (Vaughan)

Reference

Hopkins, E. F. The effect of lactic acid on spore production by *Colletotrichum lindemuthianum* Phytopath. 12: 390-393. Aug. 1922.

Rust caused by *Uromyces appendiculatus* (Pers.) Lév.

The amount of bean rust present each year apparently fluctuates less than that of most other diseases. It was reported as more than last year in Massachusetts, Delaware, Ohio, Indiana and Illinois. Even in these states no serious loss was recorded. Other states where it was found are Vermont, Connecticut, New York, Maryland, West Virginia, Kentucky, South Carolina, Georgia, Mississippi, Texas, Michigan, Wisconsin, Minnesota, Iowa, North Dakota, Missouri and Colorado. The disease appears late in the season so that the dry beans being almost at maturity suffer only minor losses. The first recorded appearance was at Westville, Connecticut June 30. During July it appeared in Illinois and Delaware, during August in Ohio and New York, and during September in Vermont, Wisconsin, Minnesota and Missouri. The rust is more common on the pole beans than on the dwarf varieties. In six states the Kentucky Wonders were mentioned as being extremely susceptible. No control measures were reported.

Vermont: Noted locally, very bad on pole limas, but also on dwarf pole horticultural and black wax, but not so abundantly. Not seen on field beans. (Lutman)

Connecticut: Two reports, first June 30, Westville. This report was of the I stage, the first time we have found it in this state. Kentucky Wonder in both reports. (Clinton)

Kentucky: J. L. Van Arsdell of Sharpsburg reported on August 16 that rust was so bad on pole, bunch and cornfield beans that he expected the crop to be destroyed. (Valleau)

Florida: The disease was quite general in all shades where beans were planted after tobacco. Kentucky Wonder and Refugee are the varieties generally planted. The Refugee appears to be very resistant. The growers do nothing to control this disease or any other. They plant the land under the shades with some crop so they will get some returns from their labor involved in clean cultivation. (W. B. Tisdale, Aug. 8)

Mosaic

Mosaic, though not reported as often as anthracnose or blight, was present in almost all bean growing areas. In the past it has caused great reductions in yield, and in the pea bean sections the growers have given up bean growing, or turned to the use of other types. With the advent of the Robust pea bean, the entire situation was changed. Farmers are now increasing their pea bean acreage each year. Furthermore, the plant pathologists and plant breeders are busy crossing both snap and dry bean strains with the Robust as one of the parent plants in an attempt to develop mosaic-resistant varieties of the different commercial types.

New York: Important in fields of susceptible varieties. Nearly all dry beans now grown in the state are resistant varieties. Since beans resistant to the more serious diseases are grown, the acreage has been increased enormously. (Chupp)

Indiana: On August 8 an examination was made of a plot of 52 seedsmen's varieties grown by H. D. Brown and 35 showed mosaic, probably of seed origin. In general only low percentages were mosaic but in Refugee from several sources, a high percentage occurred, as also in Golden Wax, Dwarf Horticultural, Flageolet Violet Wax, White Marrow, and Hodson Wax. None occurred among several plots of bush Limas. (Gardner)

Of the varieties noted free from mosaic last year, Wardell's Kidney Wax (120 plants) and Black Valentine (42 plants) were free this year.

Improved Goodard and Webber Wax were not tested this year.

The varieties noted to be free last year which showed mosaic this year were:

	No. of plants	No. mosaic	%
Red Kidney..........	333	6	2
Saddleback Wax.......	161	13	8
Dwarf Horticultural..	120	58	49
Robust Pea..........	230	3	1.3

Kentucky Wonder very susceptible, and seed usually infected.

(See also Plant Disease Bulletin 6: 93, 126. 1922)

Table 35. Prevalence of, and estimated losses from, mosaic in the United States in 1922.

State	Estimated % loss	State	Estimated % loss	State	Estimated % loss
Vermont	Present	Maryland	Trace	Louisiana	Trace
Massachusetts	Trace	Mississippi	1	Iowa	2
Connecticut	.5	Tennessee	1	Idaho	5
New York	1-3	Indiana	3	Washington	2
Pennsylvania	2-3	Wisconsin	Trace	Oregon	Present
Delaware	Present	Minnesota	2	Utah	1

References

Matsumoto, Takashi. Some experiments with adzuki-bean mosaic. Phytopath. 12: 295-297. June 1922.

Nelson, Ray. Transference of the bean mosaic virus by Macrosiphum solanifolii. Science n.s. 56: 342-344. Sept. 22, 1922.

> "The spread of bean mosaic was observed during 1921 under conditions which strongly suggested transfer by insects. The sudden appearance of the disease in the water cultures of beans growing in the greenhouse, and infested with aphids, indicated even more definitely the mode of dissemination. Definite proof of the transfer of the virus by Macrosiphum solanifolii was obtained under controlled conditions, both in the greenhouse and in the field."

(See also references under potato mosaic)

Root rot caused by Fusarium spp.

It is difficult to summarize the data on root rot, because the collaborators are not always sure of the cause. The organisms by all means should be identified, if that were possible, so that when dry root rot is mentioned it can be said that it is caused by Fusarium martii phaseoli or some other Fusarium. No doubt Dr. W. H. Burkholder, Cornell University, Ithaca, New York, who described the organism, would be willing to identify specimens of dry rot if they were sent to him. The following states have reported a Fusarium root rot of beans: Vermont (very abundant, 1% loss), Massachusetts (1%, Fusarium and Rhizoctonia general), Connecticut (.5%), New York (2-5% loss), Pennsylvania (3%), Maryland (trace), Virginia (trace), West Virginia (trace), Kentucky, South Carolina (trace), Florida, Mississippi (1%), Louisiana (trace), Illinois (trace), Wisconsin (0); Minnesota (trace), and Quebec, Canada. In the South the Fusarium is more of a damping-off organism. (See also Plant Disease Bulletin 6: 93, 127, 136. 1922). Burkholder (New York) writes as follows:

> "I have received specimens of root rot of beans from only Vermont and Michigan that I felt sure were caused by Fusarium martii phaseoli. Last summer, however, some specimens were sent in from Indiana and Washington, D. C. which I thought were the same disease, but they were in a rather bad condition and I was not positive."

Control measures

In New York and possibly in other states attempts are being made to breed root rot resistance into some of the more commonly used varieties.

Other diseases

Powdery mildew caused by Erysiphe polygoni DC. was reported from West Virginia, South Carolina, Florida and Texas. In no case was there any appreciable damage. John L. Sheldon (West Virginia) writes: "This is the first time I recall finding a powdery mildew on beans. Three species of clover - all mildewed - were growing near the late-planted beans and I expect this rare infection came from the clover."

Leaf spot caused by Cercospora cruenta Sacc. was found in Texas where it did only a trace of injury, and from Gadsden, Florida, from which place W. B. Tisdale writes: "The disease appeared on lower leaves during period of wet weather; variety, Kentucky Wonder. The affected leaves shed and the disease did not appear on the upper leaves."

Angular leaf spot caused by Isariopsis griseola Sacc. was observed August 31 at Walhalla, South Carolina, and was common and destructive to a few late bunch beans in a garden in Morgantown, West Virginia.

Vine and pod rot caused by Sclerotinia libertiana Fckl. was reported from New York, where it caused .5-1% injury. It was prevalent in low fields where the vines were extremely large. According to observations made by F. R. Perry the disease was worse in fields where Sclerotinia appeared the year before, and no rotation of crops was practiced. It was also one of the serious transportation rots of snap beans.

Rhizoctonia stem rot caused by Corticium vagum B. & C. severe on late plantings of snap beans in Texas. Taubenhaus reports 50% loss of these plantings. In Louisiana it was also more severe on the fall crop than that planted in the spring. The first report was November 9. The same trouble was reported from Florida, Mississippi, and Idaho.

Southern blight or wilt caused by Sclerotium rolfsii Sacc. was observed in Texas (very prevalent), Louisiana (1-2% loss, first observed May 1), and South Carolina (trace).

The Texas root rot caused by Ozonium omnivorum Shear was reported by Taubenhaus of Texas as causing 8% loss.

Root knot caused by Heterodera radicicola (Greef) Müll. was reported in South Carolina and Texas. In South Carolina it was also found on the Mung beans, two rows of which were practically destroyed. In Texas, Taubenhaus estimated the root knot loss at 2%.

Hopperburn caused by Empoasca mali was observed July 10 at Madison, Wisconsin. It was serious on beans which grew adjacent to potatoes.

A non-parasitic pod spot of bean was reported by Dana of Washington.

Chlorosis caused by too much lime in the soil resulted in 1% loss according to Taubenhaus of Texas.

DISEASES OF LIMA BEANS

Downy mildew caused by Phytophthora phaseoli Thax.

Downy mildew does an immense amount of injury to the lima bean crop in the eastern part of the United States, and was especially abundant this year. It was present in Connecticut, New York, New Jersey, Pennsylvania, Delaware, Virginia, West Virginia and Ohio. The epidemic was most pronounced on Long Island and in New Jersey, gradually diminishing westward until in Ohio it caused only a slight loss. On Long Island it was first found August 5, Connecticut August 9, Delaware in September, and in Ohio October 3.

Connecticut: More than usual; ten reports, quite serious in some fields. Earliest report of the disease August 9 at Westville. Sixty-five percent of crop injured in one field, and 20% loss is estimated for the state. (Clinton)

New York: In Mattituck section by middle of August the disease became very prevalent and by September 1 the pods on hundreds of acres were covered with white mould. Earliest recorded appearance was August 5. Destroyed all beans on late planting, and reduced the crop on the early planting. (Clayton - Long Island)

New Jersey: In Monmouth County 10% of a planting of 2,000 acres were not picked due to attack by this disease. Av. yield 90 cases of beans per acre,- this year 67 cases. (Dept. of Plant Pathology)

Virginia: Severe loss of pods at Edinburg, Shenandoah County. (Fromme)

West Virginia: Local. Very severe case observed in Marion County. There was a trace of loss for the entire state, but as high as 95% was found in one field. (Department of Plant Pathology)

Other diseases

Bacterial blight caused by *Bacterium phaseoli* EFS was noted on bush limas in Marion County, Indiana, October 4. (Gardner).

A *bacterial leaf spot* was reported from Connecticut and Delaware. In the former state it was recorded for the first time. G. P. Clinton suggests that it is probably the disease reported by Tisdale and Williamson. It was found June 20 at East Hampton. In Delaware *Bacillus laythri* Manns & Taub. is suggested as the cause of the leaf spot. In neither case was it of economic importance. The new bacterial organism which has been described on common beans by F. Hedges (A bacterial wilt of the bean caused by *Bacterium flaccumfaciens*. nov. sp. Science n.s. 55: 433-434. 1922), was successfully inoculated into Lima bean plants also.

Yeast spot caused by *Nematospora phaseoli* Wingard, was general in the middle and tide water sections of Virginia, producing 5% reduction in the crop. The maximum found in any one field was 75%. The disease seems to flourish better in the warmer sections. It spots and shrivels the seed. *Reference*: Wingard, S. A. Yeast spot of lima beans. Phytopath. 12: 525-532. 1922.

Pod blight caused by *Diaporthe phaseolorum* (C. & E.) Sacc. (*Phoma subcircinata* E. & E.) was found in July at Houston, Delaware, and although more common than usual, was not of economic importance.

Rust caused by *Uromyces appendiculatus* (Pers.) Lév. was observed in Vermont (on pole Limas, locally very bad) and in Pennsylvania.

Stem rot caused by *Sclerotinia* sp. was reported from Marion County, Indiana May 24. It was not important. A *Fusarium* on Lima beans was collected once in Hamilton County, Ohio, September 18.

Anthracnose caused by *Colletotrichum lindemuthianum* (Sacc. & Magn.) Br. & Cav., was reported only from West Virginia.

DISEASES OF ONION

Smut caused by *Urocystis cepulae* Frost

"An investigation by L. R. Jones and J. C. Walker of the relation of soil temperature to the development of onion smut showed rapid development of the disease at 60° F and when the temperature rose to 84°F it was completely checked." ((1) Abst. from Exp. Sta. Rec. 47. Oct. 1922) The temperature accounts for the presence of the smut only in the northern tier of states. Certainly the inoculum must have been carried farther south than northern Indiana and Ohio. The disease has gradually increased in the older onion sections until some soils are no longer profitable for onion growing. In Orange County, New York, which is a typical onion section, M. C. Hammond made a series of counts in different localities and found from 18 to 36% of smut, depending upon the length of time the land had been farmed. Smut was reported from Massachusetts (5%), New York (20%), Ohio, Indiana, Wisconsin (a maximum in some fields of 60%), and in Oregon. In Iowa no smut was observed. In Wisconsin the disease was first observed May 15 at Racine, and in Orange County, New York in June. (Also see Pl. Dis. Bul. 6: 137. 1922)

Control measures

The formaldehyde drip is generally used, and is commercially very profitable.

> "All investigators have employed essentially the same type of apparatus which has no provision for eliminating variation in rate of application due to reduction of pressure as the column of liquid lowers in the open tank and to speed of operator. To obviate these difficulties a new type of apparatus has been developed at the Massachusetts Agricultural Experiment Station. The chief features of the improved equipment are: (1) a tank made air-tight at the top by a screw-cap, air to replace the liquid being admitted through a stand-pipe attached near the bottom which eliminates variation in rate of flow due to diminishing head; (2) changeable discs with graded openings which fit into a union in the delivery pipe regulate the size of the outflow stream to correspond with the rate at which the operator walks. A table based on formulae of application and the time it was found that different operators required to push the drill a certain unit of distance indicates to the operator which of the numbered discs to use." (Osmun, A. V. and P. J. Anderson. (Abstract) Phytopath. 13: 58. Jan. 1923)

New York: Farmers who do not use formaldehyde sow ten pounds seed an acre. With formaldehyde they sow six to seven pounds. The difference is enough to pay for the formaldehyde used. (Chupp)

(Orange County) - Onions in general in good shape considering the conditions in that section and the character of the growers. On June 16 I made counts of smut and found the following on the different tests:

John Volock	Check plot	6% smut
	Formaldehyde treated	2% "
Bernard Dowd.......	Check plot	15% "
	Formaldehyde treated	3% "
	Field lime-sulfur treated	32% "
Frank Kurowski	Check plot	19% "
	Formaldehyde treated	2% "
John Meany	Check plot	40.4% "
	Formaldehyde treated	6% "

This test shows up to the best advantage of any that I have so far had.

Stanley Raubnski....	Check plot	31% smut
	Formaldehyde treated	5.6% "
	Lime sulfur	35% "

(M. C. Hammond, N. Y. St. Coll. Agr. Dept. Pl. Path. & Ent. Weekly News Letter, June 26)

Ohio: Only one report. Disease not believed to be serious this year in state. Formaldehyde drip attachment in general use in onion sections. (Thomas)

Indiana: Occurred in Lake County only. Gregory reports smut not destructive because it thinned the stand and enabled the healthy plants to better endure the drouth. Gregory found trouble from rain dilution of the formaldehyde in the soil. (Gardner)

Wisconsin: Well under control by formaldehyde drip treatment. Growers have arranged 60-gallon tank on horse-drawn drills. (Vaughan)

Oregon: Serious and destructive in northern Willamette Valley onion sections except where formaldehyde disinfection of the drill row at seeding time was practiced. Not all fields are affected as yet. (Barss)

Recent literature

(Cited)

1. Plant disease investigations. Wisconsin Agr. Exp. Sta. Bul. 339: 32-38, 39-48, 113. 1922.

(Not cited)

Anderson, P. J. Development and pathogenesis of the onion smut fungus. Massachusetts Agr. Exp. Sta. Tech. Bul. 4: 99-133. Nov. 1921.

Gregory, C. T. The relation of rain to the formaldehyde treatment of onion smut. Phytopath. 12: 155-156. March 1922.

Osmun, A. V. and P. J. Anderson. An improved formaldehyde tank for the onion drill. (Abstract) Phytopath. 13: 58. Jan. 1923.

Other diseases

Downy mildew caused by *Peronospora schleideni* Unger. is reported from surprisingly few states, and in none was it of any special importance, unless it be in New York where the estimated loss is 2 to 3%. Other states where it was present are Louisiana, Ohio, Wisconsin, Washington and Oregon. In New York it was first observed July 20 in Chenango County, and in Wisconsin, August 1 at Phillips.

Leaf mold caused by *Macrosporium parasiticum* Thüm. and *M. porri* E. has been included in the reports from Massachusetts, New York, Louisiana and Minnesota. In Massachusetts there is an increase of the disease over last year, the trouble being confined largely to the Connecticut Valley. In Louisiana 50 to 75% of the seed onions are attacked, with a resulting loss of 30 to 50%. In Minnesota there was only a trace of the disease. The trouble was first observed in Louisiana in April, and in Ramsey County, Minnesota, July 7.

Smudge or *anthracnose* caused by *Colletotrichum circinans* (Berk.) Vogl.

was observed on white onions in Delaware, Indiana and Wisconsin. Vaughan of the latter state says that "white onions little grown commercially. Red variety largely grown is highly resistant." Reference: Averna Sacca, Rosario. Colletotrichum circinans (Berk.) Vogl. Bol. Agr. Sao Paulo 23: 76-78. 1922.

Black mold caused by Aspergillus niger Van Tieghem was found once in New York (July 27, Erie County), caused .5% injury in Texas, and was reported in six carloads from Indiana by inspectors of the Bureau of Agricultural Economics.

Bacterial soft rot was reported as causing considerable loss in market gardens at Lynchburg, Virginia (Fromme). J. J. Gardner of Kenton, Ohio (Bur. Agr. Econ. Fruit & Veg. Div. Letter Oct. 12, 1922) writes: "I have seen considerable stock from different places around the marsh and it all runs heavy to decay, Neck Rot and Slimy Soft Rot. I expect that all of this stock from here will show considerable decay on the markets."

Neck rot caused by Botrytis allii Munn was present in New York, Ohio, Indiana, Wisconsin, Idaho and Washington. Vaughan of Wisconsin estimated that the loss was only a trace in his state. None of the other collaborators ventured an estimate. Inspectors of the Bureau of Agricultural Economics reported it in 18 cars of onions from six localities in Indiana. (Gardner)

Rot caused by Fusarium sp. was widely distributed, being found in New York, South Carolina, Indiana, Wisconsin, Idaho and Washington. In New York it was reported once from Erie County, July 27. In South Carolina it was of some importance in Anderson County where it was observed January 6. Vaughan of Wisconsin states that it was "complicated with maggot injury. Difficult to say which is most responsible." Heald (Washington) writes that "Fusarium rot has caused heavy loss of onions in the truck section of Walla Walla."

Pink root caused by Fusarium malli Taub. was reported from New York, Texas, Wisconsin, and Oregon. There was a trace of injury in New York and Wisconsin. In Texas the loss was 5% and for Oregon, Barss reports that in a number of fields in Washington County there was considerable evidence of root damage due to some apparent disease suspected to be pink root. (See Plant Disease Bulletin 6: 137-138. 1922) The disease was first noted in Wisconsin July 1 at Racine. References: Howitt, J. E. Two diseases new to Ontario. Scient. Agr. 3: 189. Jan. 1923. Whetzel, Herbert H. The pink-root of onions. Agr. Bul. Bermuda Dept. Agr. July 1922.

A slimy soft rot was unusually serious both in the field and storage in the Connecticut River Valley of Massachusetts. (Osmun)

DISEASES OF CRUCIFERS

CABBAGE

Club root caused by Plasmodiophora brassicae Wor.

The area where club root was of importance in 1922 was rather limited. The boundary line of this area was roughly the southern end of Pennsylvania, as far west as Minnesota, and to the Canadian border. It is not generally distributed over the states included in this area, but is more or less localized. When the organism is once introduced into a community, the extent of the infested soil gradually enlarges.

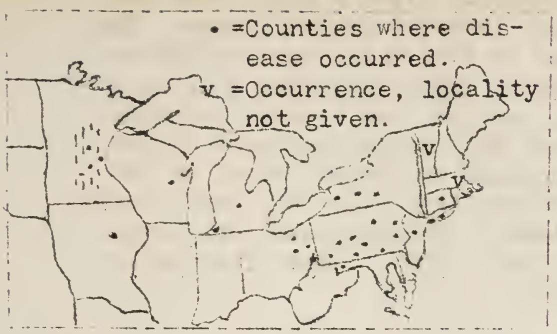

• =Counties where disease occurred.
v =Occurrence, locality not given.

Fig. 8. Distribution of club-root by counties, as reported by collaborators in 1922.

New York: Common but not usually serious. One field with 90-100% infection due to use of refuse from kraut factory as fertilizer. (E. E. Clayton)

Michigan: Cabbage club root and yellows found by Nelson to be very serious about trucking section near Grand Rapids. Liming 3 T to acre reported successful with many in control of club root. (Coons, July 1922)

Wisconsin: Several fields near Racine have been abandoned. for cabbage. The outbreak at Appleton was in seed bed. Infected plants had been set in several fields before observed. (Vaughan)

North Dakota: One instance reported in 1920, but not observed since then, although it may be present. (Weniger)

Club root apparently was present in its usual degree, excepting in Massachusetts and Minnesota where more was reported. The percentages of loss given are Vermont (1-3%), New York (2%), Maryland (1%), and Michigan (trace).

Weather relations

> "Studies by J. Monteith, Jr., of the soil temperature and moisture relations of cabbage clubroot showed a wide range of temperature in which the fungus could develop, but when the moisture content of the soil was reduced to one-half its water-holding capacity there was no development in most soils." (Plant disease investigations. Wisconsin Agr. Exp. Sta. Bul. 339: 32-38, 39-48, 113. 1922. Abst. from Exp. Sta. Rec. 47. Oct. 1922)

Table 36. Earliest recorded appearance of club root in 1922.

Date	Place	Date	Place
June 15	Appleton, Wisconsin	August 3	Storrs, Connecticut
July 17	Ramsey County, Minnesota	August 27	Stark County, Ohio
July	Cortland, New York	September 25	Vermont

Control measures

> "Experiments were begun in 1915 in cooperation with the department of horticulture for the control of clubroot of cabbage. The soil was treated with Bordeaux mixture, ammoniacal copper carbonate, formaldehyde, sulphur, and lump lime. The residual effects of Bordeaux

> mixture and lime were apparent after 4 years, but the soil was again thoroughly infested after 6 years. The treatments were repeated in 1921 with copper-sulphate solution, Bordeaux mixture, lump lime, milk of lime, ground lime-stone, lime sulphur, and nicotin sulphate. One year's planting since the second treatment showed that Bordeaux mixture applied in amounts equal to the heaviest treatment of calcium oxid gave the best results. Lime sulphur was injurious." (Pennsylvania Agr. Exp. Sta. Bul. 170: 15-19, 19-20. 1922. Abst. from Exp. Sta. Rec. 47. Oct. 1922)

References

Nicoloff, Th. & M. Stefanova. Die kohlhernie in ihren beziehungen zur wirtspflanze. Biedermann's Zentralbl. 51: 101-102. 1922. Mitt. aus Landw. Versuchrst. Sofia. German abstract by Richter.

Schaffnit, Ernst. Versuche über die empfänglichkeit verschiedener kohlsorten für den errengen der kohlhernie. Deut. Obstbau. 68: 211-212. 1922.

Sommer, Heinrich. Kohlhernie-bekämpfung mit uspulun im jahre 1921. Gartenw. 26: 70-71. 1922. (Also in Deut. Obstbau. 68: 43-44. 1922)

Vercier, H. J. A propos des maladies du chou: le gros pied. Rev. Hort. 94: 146-148. 1922.

Yellows caused by *Fusarium conglutinans* Woll.

Yellows, as has been shown by past research, is favored by higher temperatures and therefore is more common in the states where the temperature is relatively high in summer. New England and New York have not suffered much loss but in other states where yellows is abundant the loss is appalling.

Pennsylvania: Very general in counties reported (southern half of state); mostly garden patches. (Orton & Thurston)

Ohio: Yellows is becoming a serious limitation to early cabbage growing in the state. (Thomas)

Iowa: Serious around Muscatine and along Mississippi. (Melhus)

Missouri: Hot dry weather in June favorable to development of disease. (Rosa)

Occurrence general, 1 to 50% of crop injured. None in the common early varieties. (Maneval)

North Dakota: Disease has never been severe in state. Found in other years in isolated instances. Either the disease is not prevalent here as yet, or our varieties are resistant. (Weniger)

(See also Pl. Dis. Bul. 6: 39, 62, 125, 147. 1922)

Table 37. Prevalence and losses of cabbage due to yellows in 1922.

State	Prevalence compared with		Estimated percentage losses or importance	State	Prevalence compared with		Estimated percentage losses or importance
	Last Year	Average Year			Last Year	Average Year	
N. Y.			Present	Ind.	More	More	5
Pa.			Present	Ill.	More	More	5
Del.			.5	Mich.			Very serious
Md.	Same	Same	8	Wis.	More	More	
Va.	Same	Same	Most important	Ia.	More		25
Ky.	Less	Less	3.5	Mo.		Less	10
S. Car.			Trace	N. Dak.		Less	Present
Miss.			General	Kans.	More	More	35
Tex.			18	Colo.			Present
Ark.	Same	Same	15	Mont.			Present
Ohio			Limiting factor				

Table 38. Dates of earliest recorded appearance in 1922.

Date	Place	Date	Place
January 24	John's Island, South Carolina	June 3	Corliss, Wisconsin
April 13	Coshocton County, Ohio	June 13	Douglas County, Kansas
June 1	Somerset, Virginia	July 15	Denver, Colorado
June 1	Vincennes, Indiana	July 22	Saline County, Illinois

Susceptibility and control

Dr. L. R. Jones and his associates have done an exceptionally fine piece of work in the selecting of disease resistant cabbage. Not only has it had a direct effect upon cabbage growing, but it has stimulated the selecting and breeding of other vegetables for disease resistance. The obtaining of resistant varieties is the only practicable method of control of yellows. The difficulty is not so much in procuring strains desirable, as it is in keeping the strains pure when distributed among commercial firms. Vaughan suggests a government testing agency to overcome this drawback.

Delaware: New Brunswick and All Seasons prove resistant in the demonstration work. (Adams)

Virginia: Most important cabbage disease. A considerable acreage planted with resistant All Seasons which proved resistant. Supposed resistant Wisconsin Hollander fell down badly. (Fromme)

Indiana: Limiting factor, everywhere with crop. Gregory noted yellows in Lake, Marion and Vigo Counties. Use of resistant varieties is very general. Gregory is assisting Indianapolis market gardeners to develop a resistant early variety. He distributed resistant seed to growers in 32 counties. (Gardner)

Wisconsin: Eastern section, reported for first time as far north as Marinette. Period of high temperature in May stimulated development. Another case of failure of commercially produced resistant seed to stand up. We need a government testing agency to have seed proved before offered for sale. Checked about August 1 following rain and cooler weather. (Vaughan)

Kansas: All Seasons and Brunswick resistant if planted in sterile hotbed and transplanted. Susceptible when sown late in open field. Copenhagen susceptible. (Stokdyk)

References

Gregory, C. T. Cabbage yellows. Purdue Agr. Ext. Bul. 104: 1-8. 1922.

Jones, L. R. and J. C. Walker. Yellows - resistant cabbage varieties. Some necessary precautions for seedsmen to consider in the production and distribution of seeds of new special strains. Seed World 13^3: 20-21. Feb. 1923.

Jones, L. R., J. C. Walker and E. C. Tims. Work upon Fusarium-resistant cabbage in 1922. Phytopath. 13: 57. Jan. 1923.

> "The work of the last two summers with disease resistant cabbage has been essentially a continuation of that of preceding years with increasing attention to securing Fusarium resistant strains of certain early varieties. In this the developments promise ultimate success although technical difficulties in holding the early varieties over for seed production have slowed up progress. In addition to established strains of the three later varieties (Hollander, All Seasons, and Brunswick), we have promising resistant strains of the earlier varieties (All Head and Glory)."

Manns, T. F. Cabbage wilt and stem rot in Delaware. Delaware Agr. Exp. Sta. Bul. 132: 3-24. June 1922.

Walker, J. C. Fusarium-resistant cabbage. (Rev. of: (1) Jones, L.R., J. C. Walker, and W. B. Tisdale. Fusarium resistant cabbage. Wis. Agr. Exp. Sta. Res. Bul. 48: 1-34. 1920. (See Bot. Absts. 10, Entry 99). (2) Jones, L. R. and J. C. Gilman. The control of cabbage yellows through disease resistance. Wisconsin Agr. Exp. Sta. Res. Bul. 38: 1-70. 1915.) Bot. Gaz. 73: 155-157. 1922.

Black rot caused by Bacterium campestre (Pammel) EFS

In the eastern part of the United States there was more black-rot than usual, while in the middle west the prevalence was the same or less. Undoubtedly, a big percentage of the disease is caused by infection from the bacteria on the seed. It is understood that some of the large cabbage seed producers will undertake to disinfect the seed before placing it in the hands of seed distributors. If this is done generally it will mean almost the entire elimination of black rot from among the diseases of cabbage, and will be a saving of thousands of dollars to farmers.

Kentucky: Infection could be traced in some cases to certain lots of seed. (Valleau)

Florida: Black rot was severe over the entire state the past season. (Burger)

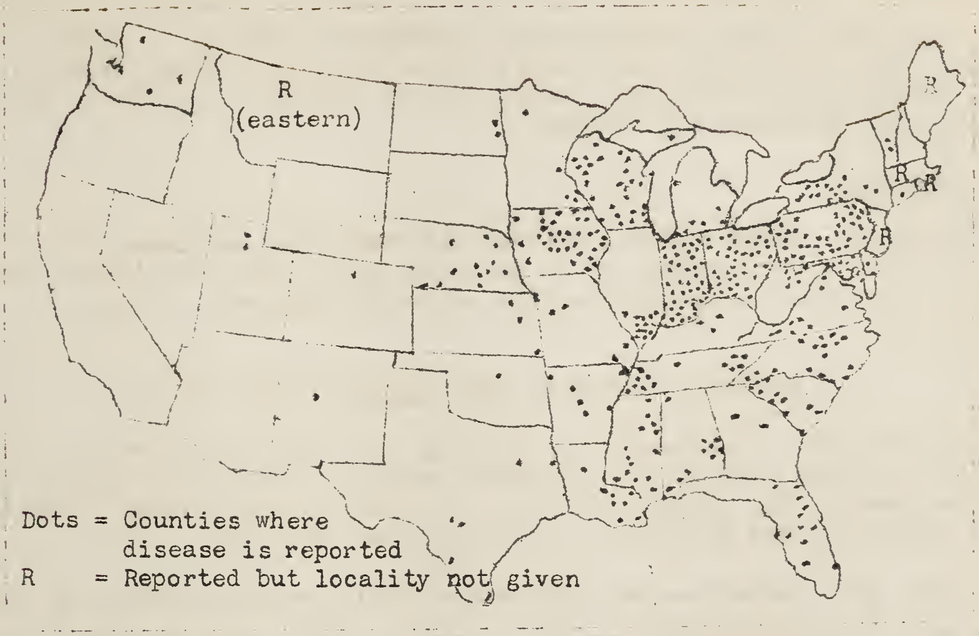

R
(eastern)
R
R
R
R
Dots = Counties where disease is reported
R = Reported but locality not given

Fig. 9. Distribution of black rot of cruciferous hosts, as indicated by reports to the Plant Disease Survey, 1903-1922.

Table 39. Prevalence of, and losses from black rot of cabbage in 1922.

State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percentage losses or importance	State	Prevalence compared with Last Year	Prevalence compared with Average Year	Estimated percentage losses or importance
Vt.	More	More	1	La.			2-10
Mass.	More		General	Tex.			3
N. Y.	More	More	5-10	Ohio			Present
Pa.		Same	Present	Ind.			Not serious
Del.	More	More	.5	Ill.	Same	Same	1
Md.			Trace	Wis.	Less	Less	2
Ky.	More	More	2.5	Minn.	Less	Less	Present
S. Car.			Trace	Ia.	Same	Same	Trace
Florida	Same	Same	Severe	N. Dak.			0
Miss.			Damage slight				

Mississippi: Reported from Copiah, Hinds, Stone, Pearl River and Lauderdale Counties. Damage slight in all localities reporting the disease. (Neal)

Louisiana: Most severe on the crop that runs into the warm weather in the spring. In some places evidently brought in on seed. (Edgerton)

Indiana: Gregory attributes infection to disease-carriage on seed imported from Long Island. Not treated. (Gardner)

Dates of earliest appearance are as follows: January 6, Arabi, Louisiana; May 10, Wiggins, Mississippi; June 12, Central City, Illinois; July 7, Ramsey County, Minnesota; July, Newark, Delaware; August 20, Madison, Wisconsin; and September 25, Vermont.

Control measures

New York: Where seed was treated with corrosive sublimate for twenty or thirty minutes, or in hot water 133°F. for ten minutes, the disease was much reduced or entirely eliminated. (Chupp)

Black-leg caused by *Phoma lingam* (Tode) Desm.

In New York, Pennsylvania and Arkansas there was a big increase in the amount of black-leg present. The earliest report of the disease was April in Nassau County, Long Island, New York. On June 27 it was found in Ramsey County, Minnesota, and on July 20, at New Castle, Delaware.

Table 40. Prevalence and importance of black-leg of cabbage in 1922.

State	Estimated percentage loss or importance	State	Estimated percentage loss or importance
Massachusetts	Unusually severe	Arkansas	20
New York	5	Ohio	General
Pennsylvania	Maximum 90%	Indiana	Present
Delaware	1	Wisconsin	Trace
Maryland	1.5	Minnesota	Not important
Virginia	Present	Iowa	" "
Louisiana	Slight		

New York: According to I. H. Vogel, black-leg was found in seed fields in Mattituck, Suffolk County, representing about 1% of the acreage under observation. Seemed fairly favorable although very little pod infection occurred. (E. E. Clayton)

Much rain, which increased the amount of disease. Several seed growers up-state inadvertently got black-leg in their seed stock and the organism was pretty well distributed. (Clayton and Chupp)

New Jersey: Abundant in Camden County, present in other parts of state. June and July wet. (Department of Plant Pathology)

Arkansas: Little or no treatment. Some large plantings were made that were a total loss. (Elliott)

Indiana: Gregory noted 100% loss in one field (Marion County) and 10% loss in a field in DeKalb County. Traced one case to seed bed infection. (Gardner)

Wisconsin: Much less around Racine. Large amounts of seed treated, or seed from inspected fields from clean stalks. Also less frequent rains during seed bed stage. (Vaughan)

Control measures

As in black rot, a large part of the infection is derived from the organism carried with the seed. In the case of black-leg, however, the fungus is beneath the seed coat and thus not affected by ordinary treatment. Dr. J. C. Walker in experimental work (1) has shown that treating with hot water, 50° C. (122° F.) for 30 minutes will kill the fungus. The treatment is so drastic that the viability of the seed is reduced materially, and should not be practiced excepting when the known presence of black-leg makes it imperative. The larger seed producing companies are beginning to take precautions against having the mother seed stock infected, and it will probably be only a matter of time before the disease will be greatly reduced in this manner.

Literature
(Cited)

1. Walker, J. C. The hot water treatment of cabbage seed. Phytopath. 13: 251-253. May 1923.
   ____________ Seed treatment and rainfall in relation to the control of cabbage black-leg. U. S. Dept. Agr. Bul. 1029: 1-27. Mar. 1922.

Black mold or leaf spot caused by Alternaria brassicae (Berk.) Sacc.

Leaf spot was common in the following states: Connecticut, New York, Ohio, Delaware, Florida, Louisiana, and Wisconsin. It probably was present in nearly all the states east of Minnesota, but no records were received for this season. In previous years, leaf spot has been reported from every state east of the Mississippi River, excepting New Hampshire, Vermont and Tennessee. It has been reported from six states west of the Mississippi, namely, Louisiana, Minnesota, Kansas, Texas, Washington, and California. In New York in 1922 it was important in all parts of the state, but was present as an epidemic in the Cortland Valley. The loss was estimated at 2%. On Long Island in the cabbage seed district it always does injury as a seed pod spot. I. H. Vogel reported it as not serious in Suffolk County in 1922. In the other states the loss was only slight. In Louisiana it was first observed January 6; in Delaware, June 19 at New Castle; and in New York during July in the Cortland Valley.

Control measures

New York: Seed treated with $HgCl_2$ showed Alternaria when cultured. A 100% killing of Alternaria in the seed with hot water 56° C. (133° F.) for ten minutes. (Chupp)

References

A new Alternaria on leaves of cabbage and cauliflower is reported by Milbrath from California. He calls the organism, Alternaria oleracea n. sp.

Milbrath, D. G. Alternaria from California. Bot. Gaz. 74: 320-324. Nov. 1922.

Downy mildew caused by Peronospora parasitica (Pers.) De Bary

Downy mildew usually does no serious injury to grown plants, but it has proved very destructive in the seed beds, according to the following comments.

> New York: Observed doing damage in cabbage and cauliflower plant beds. Observed also on cabbage being grown for seed where it seemed to do much damage. (E. E. Clayton, July 24)
>
> I. H. Vogel of Suffolk County says 10% seed crop injured. Fairly favorable for its development in the early maturing fields which had quite heavy growth. (Chupp)
>
> Virginia: Especially in plant beds but also in field, 75% of seedlings lost in plant bed. (Fromme)
>
> Kentucky: Destroyed bed of young cabbage plants near Georgetown, following a few days of foggy, wet weather. (Valleau)
>
> California: Reported from Oxnard, Ventura County, as causing serious injury to very young plants in seedbeds. Cotyledons are attacked and apparently destroyed, and plants are said to be killed. (Horne)

It was observed in Connecticut, New York, Pennsylvania, Virginia, Kentucky, South Carolina, Florida, Louisiana, Texas, Wisconsin, Iowa and California. In New York 1% loss was given, while no definite percentages were suggested for the other states.

Table 41. Earliest recorded appearance of downy mildew in 1922.

Date	Place	Date	Place
January 24	John's Island, S. Car.	June 7	Georgetown, Ky.
March 25	Dumbarton, Va.	June 10	Racine, Wis.
March 30	Louisiana	August 4	Storrs, Conn.

Other diseases

Ring spot caused by Mycosphaerella brassicicola (Duby) Lindau was observed in California. W. S. Fields writes: "Mycosphaerella brassicicola on cabbage, cauliflower and broccoli in the Colma District. No data as to amount of damage, disease can be found in every field in Colma District." D. G. Milbrath adds, "In San Mateo County, 90% severe infection. Loss 15% in field. Acreage 1000."

Slimy soft rot caused by Bacillus carotovorus Jones was reported from Vermont, New York, Pennsylvania, Delaware, Maryland, Mississippi, Ohio, and Wisconsin. In Vermont the loss was estimated at from 1 to 2%; New York - Nassau County - "Soft rot on cabbage seed stalks is causing severe loss in plantings of high priced seed strains. This may enter through maggot injury. (H. C. Odell. N. Y. St. Coll. Agr. Dept. Pl. Path. and Ent. Weekly News Letter, June 19, 1922); Delaware - "Breeding trials show certain strains very susceptible." (Adams); Mississippi: "Reported from Port Gibson, Mississippi by Port Gibson Truck Growers Association as causing slight loss in the field and heavy losses in transportation. Several cars were a total loss on reaching the northern markets. Specimens were examined by me, and the disease in question is very likely Bacillus carotovorus soft-rot. This trouble was reported to this office on May 12." (Neal); Ohio - "Greatest losses have been noticed in shipments. Only an occasional report has come to us from the growers." (Thomas); and Wisconsin - "Abundant crop and only best was accepted for sale. Heads left in field went down rapidly after height of maturity." (Vaughan)

Soft rot or drop caused by Sclerotinia libertiana Fckl. was found in New York, South Carolina, Texas, Louisiana, and Indiana. It was not so destructive in New York as usual, but always causes a considerable loss in the kraut sections on late harvested cabbage. In Louisiana the loss was 3-5%. In the other states there was only a trace of injury. In Louisiana and South Carolina it was first seen in January; in Indiana it was noted in July.

Rhizoctonia solani Kuhn was responsible in Connecticut for a root rot and also damping-off of cabbage. In Nassau County, Long Island, Odell observed a similar root rot, and in Ohio, Thomas found the same damping-off. In Pennsylvania, Beach discovered Rhizoctonia causing a rot of cabbage heads, the loss being estimated as 7% for Philadelphia County.

A stem rot caused by Fusarium sp. was recorded by Dana of Washington. He also reported a non-parasitic internal black spot of cabbage.

Root knot caused by Heterodera radicicola (Greef) Müll. was reported by Taubenhaus as causing 2% loss in Texas. In previous years it has been reported from most of the Southern States.

An unknown head rot of cabbage was found in Washington and Wasco Counties, Oregon, by Barss.

There was one complaint, probably due to type of fertilization and cultivation, of leaves turning yellow and dying prematurely in fairly young plants. (Clinton, Connecticut)

Lack of heading. Lutman of Vermont had his attention called by local growers to the lack of heads on many of the cabbages and cauliflower. It was apparently due to weather and not to a parasitic organism.

General references

Harvey, R. B. Varietal differences in the resistance of cabbage and lettuce to low temperatures. Ecology 3: 134-139. Apr. 1922.

Pape, Heinrich. Kohlkrankheiten. Deutsche Landw. Pr. 49: 302-303. June 3, 1922.

BRUSSEL SPROUTS

Black-leg caused by Phoma lingam (Tode) Desmaz. was serious in some fields on Long Island. The loss was as high as 50% of the plants. (Clayton)

Black rot caused by Bacterium campestre EFS was also found on Long Island by Clayton. The disease was common.

CAULIFLOWER

Black rot caused by Bacterium campestre EFS resulted in serious losses to the cauliflower growers of Long Island. I. H. Vogel estimated that 40% of the crop in Suffolk County was injured, Clayton stated that, "Crop probably reduced a fifth by this one disease. Quality also affected."

Peppery spot caused by Bacterium maculicolum McCulloch was reported by Clayton (Long Island). "This spot has been very prevalent this year."

Black-leg caused by Phoma lingam (Tode) Desmaz. was present on Long Island where the loss it produced was estimated at 1 to 2%.

Club root caused by Plasmodiophora brassicae Wor. was found on Long Island and in Ohio.

Ring spot caused by Mycosphaerella brassicicola (Duby) Lindau was reported by Milbrath in California as follows: "In San Mateo County, 90% severe infection. Loss 15% in field. Acreage 2,000."

Stem rot caused by Sclerotinia sp. was present on plants started in hot beds and set out in market gardens at Indianapolis, Indiana. (Gardner)

CHINESE CABBAGE

"A new leaf disease of Chinese cabbage in Texas is found to be due to a leaf nematode." (Taubenhaus)

CRESS

Stem rot caused by Sclerotinia libertiana Fckl. occasionally was present in greenhouses in the eastern part of Massachusetts. (Osmun)

HORSE RADISH

White rust caused by Albugo candida (Pers.) Ktz. was observed near Newark, Burlington and Toms River, New Jersey. "Although there was heavy infestation of the white rust in some fields, there was no indication that any loss was produced." (Poole)

Leaf spot caused by Cercospora armoraciae Sacc. was observed in New Jersey and Illinois. Another leaf spot caused by Ramularia sp. was also mentioned by Anderson and Tehon of Illinois.

Root rot caused by Rhizoctonia sp. was reported from Washington and New Jersey. A similar root rot (cause undetermined) was found in Seneca County, New York. R. P. White names Thielavia basicola (B. & Br.) Zopf. as causing a root rot in Kansas.

Bacterial root rot caused by Bacillus sp. was reported from New Jersey by R. F. Poole as follows: "Observed near Newark and Burlington, 6% reduction in yield for State. This disease caused less loss than last year. Heavy loss occurred in storage pits just previous to the planting date. Diseased roots failed to germinate, causing many misses in some fields. A few diseased plants developed late in the growing season."

Mosaic was reported once to G. P. Clinton of Connecticut. He writes: "Apparently a new host for state. Failed to infect tobacco."

KALE

Yellows caused by Fusarium conglutinans Woll. was again observed in Marion County, Indiana. (Gardner)

MUSTARD

White rust caused by Albugo candida (Pers.) Ktz. was reported for the first time from Illinois, where it was observed July 13 at Gallatia, Saline County, according to Anderson and Tehon. It was also observed in South Carolina, Florida, and Louisiana. In Florida white rust was very common and in Louisiana it caused rather large losses in the crop.

Powdery mildew caused by Oidium sp. was found in a few places in Florida by Burger.

Mosaic was reported from Louisiana and Indiana. Edgerton (Louisiana) stated that it was severe in some localities. Gardner (Indiana) called attention to the fact that it was the same mosaic that occurred on turnips.

Leaf spot caused by Cercospora sp. produced slight injury in Louisiana.

RADISH

White rust caused by Albugo candida (Pers.) Ktz. was present in Illinois, Minnesota, and Colorado. In no case was it of economic importance.

A powdery mildew, ascribed to Erysiphe polygoni DC. by Maneval was seen in Missouri.

Downy mildew caused by Peronospora parasitica (Pers.) De Bary was observed August 26, in Ogle County, Illinois.

Black root caused by Rheosporangium aphanidermatus Edson occurs in gardens about LaFayette, Indiana in the spring and fall. (Gardner)

Damping-off caused by Rhizoctonia sp. was found in Columbiana County, Ohio.

RUTABAGA

Black rot caused by Bacterium campestre (Pam.) EFS was reported from the northwest section of Wisconsin. It caused wilting of the leaves and browning of the bundles. E. E. Clayton found a similar trouble on Long Island.

References

Strang, R. B. Diseases of the Swede crop in Cumberland and Westmorland in 1921. Jour. Min. Agr. Gt. Brit. 28: 1093-1096. Mar. 1922.

Whitehead, T. Plant diseases. Rep. Exp. Univ. Coll. North Wales 1920-1921: 40-50. 1922.

__________ Varieties of Swedes resistant to finger-and-toe. Jour. Min. Agr. Gt. Brit. 29: 362-388. July 1922.

TURNIP

Rhizoctonia - Ohio. (Thomas)

Leaf spots - Cercosporella sp., reported from South Carolina and Louisiana; Macrosporium sp. reported from Ohio. Both unimportant.

White rust caused by Albugo candida (Pers.) Ktz. was reported by Taubenhaus as causing 1% loss in Texas.

Soft rot caused by a bacterium was observed in Ohio.

References

Gardner, Max W. and James B. Kendrick. Turnip mosaic. Jour. Agr. Res. 22: 123. 1921.

> "Turnip (Brassica rapa) was found affected with a typical mosaic disease at South Bend, Indiana. The disease is communicable by rubbing and by inoculation

of wounds with expressed juice. The incubation period in January was 16 days. Radish (Raphanus sativus) is not affected and is not a 'carrier'." (Absts. from Bot. Absts. 10. Entry 1881. Feb. 1922)

Jones, S. G. A bacterial disease of turnip (Brassica napus). Jour. Agr. Sci. 12: 292-305. July 1922.

DISEASES OF CUCURBITS

CANTALOUPE

Leaf blight or leaf mold caused by Alternaria brassicae nigrescens Pegl. was present in Connecticut, New Jersey, Delaware, Maryland, Georgia, Texas, Arkansas, Ohio, and Indiana. In Maryland 20% loss is reported; in Texas, 2%; and in Indiana and some parts of Georgia, it was very serious. Control measures evidently consist in the application of fungicides or in the use of resistant varieties. Maryland: "A limited number of fields were sprayed and a few were dusted with Bordeaux. Spraying gave better results than dusting, but dust gave fair results." (Temple & Jehle); Indiana: "Noted on Tiptop and Rockyford varieties, Lafayette, in October on soils never before in cantaloupes. Gregory reports severe in Jackson and Vigo Counties. No control with insecticidal dust (calcium arsenate Gypsum)." (Gardner); Arkansas: "Only resistant varieties are used and injury is very small." (Elliott)

Bacterial wilt caused by Bacillus tracheiphilus EFS. According to the reports, bacterial wilt was somewhat more common than usual. It was present in New York, Delaware, Maryland, West Virginia, Arkansas, Ohio, Indiana, Illinois, Michigan and Kansas. A trace of injury was caused in Maryland, Illinois and Kansas, while in Indiana there was 3% reduction in the crop. The wilt seemed to have occurred in all the states almost simultaneously between July 7 and July 27. In Maryland the disease was confined mostly to the eastern half of the state, in Michigan it was in the southern half, and in Illinois it was especially prevalent in Madison County in the Poag station melon district.

Control

Ohio: Where Bordeaux mixture spray is consistently used little wilt occurs. This spray seems to act as a repellent for certain types of insects. (Thomas)

Anthracnose caused by Colletotrichum lagenarium (Pass.) Ell. & Hals. was probably present in all the cantaloupe districts of the United States, but the incomplete returns do not verify such a sweeping statement. Some varieties are extremely susceptible.

Delaware: Limiting factor in production of Honey Dew melons in Delaware. Adams)

Indiana: Found serious on Tiptop fruit, Marion County, October 5. (Gardner)

Table 42. Occurrence, estimated losses, and dates of earliest appearance of anthracnose of cantaloupe in the United States in 1922, according to collaborators.

State	Prevalence compared with: Last Year	Prevalence compared with: Average Year	Estimated percentage loss, or importance.	Earliest appearance: Date	Earliest appearance: Place
Delaware	More	More		July 26	Laurel
South Carolina	More	More	10	June 15	Furman
Arkansas	Same		Trace	June	Hope
Ohio	Same	Less	Trace	July 22	Fairfield County
Indiana			Serious locally		
Wisconsin			Trace		
Kansas			Practically none		
Arizona			Common		

Reference

Link, G. K. K. and F. C. Meier. Anthracnose of musk melons. U. S. Dept. Agr. Dept. Circ. 217: 1-4. May 1922.

Other diseases

Mosaic was reported from Delaware, where it was first observed on Rocky Ford and Pearl Pink. Growers have failed to recognize its importance." (Adams) "Gregory (Indiana) noted in June the relation between mosaic milkweed and mosaic in cantaloupe in Marion County on two farms. Diseased melons around mosaic weeds,- none around healthy weeds. No mosaic in field where no milkweeds occurred. At LaFayette, mosaic was severe in a field in which numerous milkweeds occurred. Melons had not previously been grown in this field. Also noted severe August 7 on another farm, where milkweeds abounded." (Gardner) In Ohio it was "Very severe locally, one case observed being definitely associated with the mosaic of milkweed in pasture land in an adjoining field." (Thomas)

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow. is reported only from eastern states,- namely, Connecticut, New York, New Jersey, Delaware, Maryland and Georgia. Where it occurs it is of extreme importance. Forty percent reduction in the crop was reported for Delaware, and 5% for Maryland.

Connecticut: A good season for this disease. Bad on the few vines seen. (Clinton)

Delaware: Downy mildew disease was the limiting factor in the cantaloupe production. Infection caused premature collapse of vines and not a field in the state was known to produce a normal crop. Considerable increase in acreage planted this season but only early plantings matured part of a crop. Heavy rainfall in July very favorable to prevalence of disease. Dusting work with copper arsenate dust was effective in maintaining vigor of vines but not thorough control of disease. (Adams)

Maryland: General in eastern half of state, reduced yield 5%. Controlled by spraying and dusting with Bordeaux. (Temple & Jehle)

(See also Pl. Dis. Bul. 6: 94. 1922)

Leaf spot caused by Cercospora cucurbitae E. & E. was observed at Houston, Delaware, June 28.

Fruit spot caused by Cladosporium cucumerinum E. & A. was reported from Massachusetts by A. V. Osmun.

Bacterial wilt caused by Bacillus tracheiphilus EFS - Wisconsin. (Vaughan)

Southern blight caused by Sclerotium rolfsii Sacc. resulted in 1% loss in Texas (Taubenhaus), 5 to 8% loss in Louisiana (Edgerton), and 20% loss where observed in South Carolina (Ludwig and Tisdale).

Root knot caused by Heterodera radicicola (Greef.) Müll. was prevalent in Texas, where it resulted in 1% loss, and in Arizona.

A wilt, the cause of which was not determined, was troublesome in some parts of Marion County, Oregon, according to Barss.

Hail injury was very severe in some sections of Delaware, according to Adams, who says: "Many fields a complete loss through leaf and fruit injury.

Spray injury was reported by Jehle from Maryland as follows: "Copper lime calcium arsenate dust caused some burning of cantaloupes on Eastern Shore. Not severe."

Reference

Hemmi, Takewo. On the occurrence of Mycosphaerella wilt of muskmelons in Japan. Phytopath. 12: 394-397. Aug. 1922.

CITRON

Anthracnose caused by Colletotrichum lagenarium (Pass.) E. & Hals. was reported from Canon, Delaware. (Adams)

CUCUMBER

Wilt caused by Bacillus tracheiphilus EFS

Bacterial wilt was present in its usual virulence, causing large losses in many states. The disease was observed in nearly every cucumber district but did most damage in the northern Mississippi Valley.

Table 43. Prevalence and importance of, and estimated losses from bacterial wilt of cucumber in 1922, according to collaborators.

State	Importance	Estimated % loss	State	Importance	Estimated % loss
Massachusetts	General		Ohio	Maximum 50%	
Connecticut	One report		Indiana	Worst disease of crop	
New York	Less				
Maryland		Trace	Illinois	Infection slight	
Virginia	General		Wisconsin	Widely present	8
Kentucky		22	Michigan	Many reports	
South Carolina	Unimportant		Minnesota	Unimportant	
Texas		2	Iowa		10
Arkansas	Most conspicuous		Colorado	Unimportant	

Table 44. Earliest appearance of wilt as observed by collaborators in 1922.

Date	Place	Date	Place
May 22	Hennepin County, Minnesota	July 13	Madison, Wisconsin
June 10	South Carolina	July 20	New Haven, Connecticut
July 10	New York	July 24	Henry County, Ohio
July 13	Gordonsville, Virginia	August 5	Allen County, Indiana.

New York: Caused much early damage, but has not been active since last of July. (Clayton)

Arkansas: The most conspicuous cucumber disease. Apparently does more damage. (Elliott)

Control

In a great measure, the control of wilt depends upon the control of the insect carriers. Regarding this, W. H. White (1) writes as follows:

> "The success met with by Campbell in combating *Diabrotica soror* Lec. and *D. trivittata* Mannh. in California by the use of nicotin sulphate mixed with kaolin and lime (E. S. R., 44, p. 651) led the author to conduct experiments with *D. vittata*. They were carried out at the Arlington Farm, Rosslyn, Va., during the early summer of 1921, the striped cucumber beetle being very abundant on cucurbits.
>
> "A dust containing nicotin sulphate at strengths of 4, 6, and 8%, equivalent to 1.6, 2.4, and 3.2% of nicotin, respectively, was used. The mixture containing 4% of nicotin sulphate proved as effective as higher percentages and is recommended. The dust was found to act as a repellent as well as a contact insecticide, and when properly applied drives the insects from the cracks in the soil at the base of the plants, thereby preventing serious injury. Directions are given for preparation of the dust, which should consist of 75% kaolin and 25% lime. It must be applied so as to prevent the beetle from escaping by flight, and this can be accomplished by a duster that will throw a good volume of dust quickly and with force. A cheesecloth sack or a knapsack-bellows type of duster is effective on small areas." (Abst. from Exp. Sta. Rec. 47. Abstract No. Dec. 22, 1922.)

New York: Careful spraying and dusting demonstrations were conducted but only a slight amount of wilt occurred even in the checks. (Chupp)

Kentucky: Considerable success was obtained in control of striped cucumber beetle with a spray of arsenate of lead 2 pounds, slaked lime 4 pounds, and water 25 gallons. (Gardner)

References
(Cited)

1. White, W. H. Nicotine dust for control of the striped cucumber beetle. U. S. Dept. Agr. Dept. Circ. 224: 1-8. 1922.

(Not cited)
Doolittle, S. P. Comparative susceptibility of European and American varieties of cucumbers to bacterial wilt. Phytopath. 12: 143-146. Mar. 1922.

Mosaic

Mosaic or white pickle is a close second to bacterial wilt in its destructiveness.

> "Investigations of the cucumber mosaic disease made during the past year show that it is carried over winter by the common perennial milkweed, as well as the wild cucumber. Both, therefore, according to the United States Department of Agriculture, are a menace to the growing of cucumbers, muskmelons, and related vine crops." (U. S. Dept. Agr. Clip Sheet 197. April 3, 1922)

New York: Present but not to noticeable extent. The downy mildew epidemic has probably masked much mosaic. (Clayton)

Illinois: We have trouble with cucumbers from mosaic, so much so that we are waging a campaign this spring to destroy all milkweek in this vicinity as well as to get better control of the striped cucumber beetle together with melon lice that might do any spreading of the disease. (E. A. Bierbaum)

Indiana: Statewide. Noted August 14 at LaFayette on late cucumbers planted too near diseased cantaloupe crop. Undoubtedly it is the accumulation of mosaic in the perennial weed flora (milkweeds) that has driven pickle salting stations out of one region after another. (Gardner)

Michigan: Reported from Big Rapids section. (W. W. Gilbert)

Wisconsin: Chief limiting disease factor in production. Especially bad in central and southern part of state. Thirty varieties tried,- all equally susceptible. Found also on wild cucumber, all cultivated cucurbits except watermelon and citron, on milkweed. (Vaughan)

Control measures

> "The eradication of the wild cucumber for a considerable area around cultivated cucumber fields has given encouraging results in controlling mosaic, and it is believed that the combined eradication of wild cucumber and milkweed may prove a practical means of further control." (U.S. Dept. Agr. Clip Sheet 197. Apr. 3, 1922)

Table 45. Prevalence and importance of, and losses from cucumber mosaic in 1922, according to collaborators.

State	Importance	% loss	State	Importance	% loss
Connecticut	Saw only one case		Ohio	Present	
New York	Common		Indiana	Statewide	
Delaware	Very prevalent		Illinois	Important	
Maryland		Trace	Michigan	Present	
Kentucky	Important	7	Wisconsin	Destructive	
Louisiana	Considerable		Minnesota	Very important	
Texas		Trace	Iowa	Very bad	20

Angular leaf spot caused by Bacterium lachrymans EFS and Bryan

Angular leaf spot was reported from Connecticut, Florida, Indiana, Wisconsin, Minnesota, and Iowa. In nearly all cases it was relatively unimportant. Gardner (Indiana) stated that it was "no longer a factor in the pickle crop, as a result of seed disinfection." Vaughan (Wisconsin) said that "Leaf spot has been conspicuous by its absence for several years." In Florida, however, Burger still finds injury: "This disease was present in several cucumber growing regions. The disease was reported from the markets showing that considerable damage was sustained during the shipping of the product."

Reference

Meier, F. C. and G. K. K. Link. Bacterial spot of cucumbers. U. S. Dept. Circ. 2347: 1-5. Aug. 1922.

Anthracnose caused by Colletotrichum lagenarium (Pass.) Ell. and Hals.

Anthracnose was observed in Massachusetts, New York, Maryland, South Carolina, Georgia, Ohio, Indiana, Illinois, Iowa and Wisconsin. It doubtless occurred in many other states but was not reported. Although reported as causing 8% loss in South Carolina and 1% in Iowa, it was generally not such an important disease as were wilt, mosaic or even mildew. According to Ludwig, Tisdale estimated 5 to 15% loss in the commercial sections of Bamberg, Allendale and Hampton Counties, South Carolina. Gardner (Indiana) wrote that it "occurs in Indianapolis greenhouses where overhead watering is practiced. It persists in the soil." McHatton (Georgia) - "Common and serious in some fields and gardens.

Control

Indiana: By careful watering with a hose it is being controlled in infested houses. (Gardner)

References

Bewley, W. S. Report of the mycologist. Ann. Rep. Exp. & Res. Sta. Nursery & Mark. Gard. Industr. Dev. Soc. 7 (1921): 32-41. 1922.

Bewley, W. S. Anthracnose of the cucumber under glass. Jour. Min. Agr. Gt. Brit. 29: 469-472. Aug. 1922.

"Colletotrichum oligochaetum, now most important leaf spot of cucumber in Great Britain."

__________ Anthracnose of the cucumber under glass II. Jour. Min. Agr. Gt. Brit. 29: 558-562. Sept. 1922.

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow.

Downy mildew was present in epidemic form in the cucumber sections of the far eastern states, such as Massachusetts, Long Island, and Delaware.

Table 46. Prevalence and importance of downy mildew in the United States in 1922, as estimated by collaborators.

State	Importance	Estimated % loss	State	Importance	Estimated % loss
Massachusetts	An epiphytotic	25	Maryland	Eastern Maryland	2
Connecticut	Present		Florida	Quite prevalent	
New York	Very important on Long Island	10-15	Mississippi	Considerable in Prentiss Co.	
Pennsylvania	In Center and Huntington Counties		Ohio	Negligible	
			Illinois	No report	
Delaware	In Late planted fields		Wisconsin	None reported	

In all of the eastern states the mildew appeared between August 5 and 15.

Control measures

New York: (Long Island) - Universal over Island except at extreme eastern tip (Orient Pt.). Extremely destructive, only very thoroughly sprayed fields escaping. (Clayton)

Florida: This disease was quite prevalent in the state in the cucumber growing regions. At these places where systematic spraying was carried on with Bordeaux mixture the vines remained green two weeks longer than where the vines were not sprayed. (O. F. Burger. Aug. 1922)

Other diseases

Scab caused by Cladosporium cucumerinum Ell. and Arth. was found in Marinette County, Wisconsin on 15-20% of the pickles coming to salting stations. The foliage was very free from the spots, the disease being less than in 1921. (Vaughan). It also did considerable damage in Erie County, New York (Chupp), and "occurred to a considerable extent in the vicinity of Big Rapids, Michigan" (W. W. Gilbert).

A leaf spot attributed to Alternaria brassicae Pegl. caused 5% injury in eastern Maryland, according to Temple and Jehle. A spot attributed to

Macrosporium cucumerinum E. & E. caused serious loss in some fields in southern New Jersey.

Powdery mildew attributed in Massachusetts to Erysiphe polygoni DC. and in Colorado to Erysiphe cichoracearum DC. was found in the above named states. No injury from it was observed.

Wilt caused by Fusarium vasinfectum Atk. was one of the minor cucumber diseases in Ohio.

Stem rot caused by Sclerotinia libertiana Fckl. was observed in the far separated states of Massachusetts, Idaho and Washington. It was not a serious disease in any case.

Damping-off caused by Pythium debaryanum Hesse was common in greenhouses and cold frames in Massachusetts.

The slime mould, Physarum cinereum (Batsch.) Pers. completely covered some young plants in Schnectady and Tompkins Counties, New York. The organism was determined by Dr. Frank Wann.

Root knot caused by Heterodera radicicola (Greef.) Müll. was reported from Mississippi, Louisiana, Texas, Ohio, and Washington. In Ohio the infection was found only in greenhouses. Steam sterilization was an efficient control, according to Thomas. In Louisiana the disease was important in places; in Texas there was a 2% loss; and in Wayne County, Mississippi, a ten-acre planting was seriously injured.

White tips - In one greenhouse in Connecticut the cucumber vines showed white tips due to hydrocyanic acid gas fumigation.

References

Milbrath, D. G. Control of diseases of cucumbers in greenhouses. Month. Bul. Dept. Agr. Calif. 11: 430-437. May-June 1922.

PUMPKIN

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow was reported once from Middletown, Connecticut.

Mosaic - Connecticut. "Bad; difficult to grow cucurbits in this garden on account of mosaic. Infection experiments, however, not satisfactory." (Clinton)

SQUASH

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow was generally present in Delaware. Adams says that squash is more resistant than cantaloupe.

Mosaic was everywhere in Louisisna, causing considerable loss. (Edgerton). In Texas there was a trace of the disease. (Taubenhaus).

Wilt caused by Bacillus tracheiphilus EFS was very common in New York causing 5% loss of the squash crop. It was also found in Ohio, Wisconsin and Iowa.

Fruit drop (cause undetermined) was mentioned by Dana of Washington.

Frost injury. Early plants in the Imperial Valley, California, were badly injured by frost. (C. L. Brown)

Wilt caused by Fusarium spp. - 1% loss in Texas. (Taubenhaus)

Rhizopus rot - "In Texas, great losses have requently occurred on squash fruit in the field." (Taubenhaus)

Anthracnose caused by Colletotrichum lagenarium (Pass.) E. & H.

Anthracnose was one of the serious watermelon diseases in 1922. In the past it has been reported from nearly every state where watermelons are grown. The loss which resulted was often very high, as may be judged from the few following reports of this season: Delaware, 1%; Maryland 10%; South Carolina, 25%; Arkansas, 3%; and Kansas, 2%. (See also Plant Disease Bulletin 6: 94. 1922)

Table 47. Importance and geographic range of anthracnose in 1922, according to Plant Disease Survey collaborators.

State	Importance and geographic range
New Jersey	Common in Salem, Cumberland and Gloucester Counties
Delaware	Seriously affected in some sections
Maryland	Eastern half of state
Virginia	General, especially around Smithfield
West Virginia	Destructive, especially in Ohio Valley
Kentucky	Dry weather controlled it
South Carolina	Very important; general
Georgia	Very serious
Mississippi	Especially severe in Jones County
Louisiana	Slight infection
Arkansas	Fairly severe
Ohio	5% fields in southern Ohio show disease
Indiana	Serious locally, dry weather checked disease
Missouri	Spraying gave big increases
Kansas	Maximum in one field, 85%
Arizona	Serious in North Arizona, 50% loss in Navajo and Apache Counties

Control methods

> "In the almost total absence of liquid power sprayers in the Missouri melon territory several commercial growers were advised to apply a copper compound as a dust in a good hand operated bellows-type duster."......
>
> "On the field of 150 rows from which one and one-half cars were loaded under the association rules, only 32 rows received insect protection throughout the season and nineteen of the 32 rows received copper dust. Over 80% of the merchantable melons loaded from the 150 rows came from the 32 dusted rows and over 90% of the large melons (over 36-pound average) came from these 32 rows.
>
> "From our notes it is apparent that the second application (one week after first melons have set on vines) is the calyx spray of the watermelon for when that was omitted any number of applications thereafter showed little signs of checking the disease." (Cardinell, H. A. and E. M. Page. Tests in curbing melon pests. Better Fruit 16^{11}: 6, 17-19. May 1922.

Reference

Cardinell, H. A. One season's dusting against cucumber beetles and anthracnose of watermelons in Missouri. Proc. Amer. Soc. Hort. Sci. 18 (1921): 123-130. 1922.

Stem end rot caused by Diplodia sp.

Stem end rot is primarily a transportation trouble, though Burger reports that he has found it causing a wilt of the vines. It has been reported from Maryland (1% loss) and the following three states.

Georgia: Common, controlled in melons shipped through organizations, ruined many cars where stems were not treated. (McHatton)

Florida: Stem end rot was reported from several sections this past year. The fungus was also found causing a wilting of the vines attacking them at the ground line. (Burger, August 1922)

Arkansas: Little field injury, mostly in transit. (Elliott)

Blossom end rot (cause unknown)

Blossom end rot is of extreme importance in some states. According to some collaborators the drouth seems to be a factor in producing it. In Kentucky, according to Valleau, "blossom end rot is very prevalent reducing the number of melons by one-half or two-thirds in some fields, occurring both in very small melons and on large ones; may be associated with long dry period." Charles Drechsler, in his article "A new blossom-end decay of watermelons caused by an undescribed species of Pythium," (Phytopath. 13: 57. 1923) gives the following information:

> "At Arlington Farm, Virginia, 1922, a field disease of watermelons, manifested externally by a dark chocolate brown of bluish brown discoloration, that progresses from the blossom region toward the stem end, was decidedly destructive. The rind assumed a watersoaked, candied appearance, while the discolored pulp became flaccid in consistency. The diseased parts were invariably occupied by a fungus closely resembling Pythium artotrogus DeBary in size of oogonium and oospore, and in the presence on the oogonial wall of narrowly conical radial processes. However, while in Pythium artotrogus fertilization is always accomplished by a "hypogynal" antheridium, in the watermelon parasite it is effected more frequently by multiple branch antheridia, of which from one to four are usually present. The stalk antheridia, moreover, are considerably shorter, their length and diameter being approximately equal. The fungus may occasionally enter the watermelon by wounds or by lesions caused by other fungi. Infection resulted from inoculation with pure cultures under the rind.

> "The watermelon decay attributable to *Pythium debaryanum* Hesse, which also was abundantly present in the field, is distinguished from the new trouble by light brownish discoloration of the exterior, bleaching of the pulp to pale pink, exfoliation of the epidermis on slight chafing, a peculiar strong marshy odor, and the frequent presence on the moist under-side of extramatrical mycelium."

Table 48. Prevalence and importance of blossom end rot in 1922, according to collaborators.

State	Prevalence compared with: Last Year	Average Year	% loss	Importance and geographic range
Delaware	Less	Less		Slight, general
Kentucky	More	More	60	
Texas			1	Very prevalent
Arkansas	Same	Same	5	Very common and severe
Indiana	More	More		Drouth favored this trouble
Iowa	Same			Important

Wilt caused by *Fusarium niveum* EFS

Evidently wilt was fully as destructive, if not more so, than in 1921 and 1920. Texas, Florida, Indiana, Illinois and Kansas suffered the heaviest losses.

Table 49. Prevalence and geographic range of wilt with losses incurred therefrom in 1922.

State	Prevalence compared with: Last Year	Average Year	% loss	Remarks
Maryland	Same	Same	t	
Virginia				Slight loss at Smithfield
West Virginia	Less			Observed only in Ohio Valley
South Carolina	More		t	
Georgia				General in gardens
Mississippi				Warren and Madison Counties, severe locally.
Texas			8	Very prevalent
Florida				Very prevalent
Ohio				Only one report
Indiana				A limiting factor
Illinois	More	More	25	Many fields were a total loss
Iowa				Serious locally
Kansas	More	More	3	
Arizona	More			Several places in South Arizona

Table 50. Dates of earliest appearance of wilt in 1922.

Date	Place	Date	Place
June 12	New Brookland, South Carolina	July 18	Smithfield, Virginia
June 29	Fulton County, Indiana	July 20	Ashland County, Ohio
		July 24	Cloud, Kansas

Other diseases

Downy mildew caused by Pseudoperonospora cubensis (B. & C.) Rostow. was reported from Delaware and Louisiana. In the former state the loss was 20%, being much greater than in previous years. J. F. Adams says it was "the limiting factor in maturing crop." Edgerton reports in a similar manner: "Very severe in southern Louisiana this season, defoliating and killing the plants just before ripening season. In many cases the fields appeared black."

Mosaic, or a disease resembling it, is mentioned by Jehle as attacking vines in Caroline County, Maryland. Five percent of the plants were affected. There were distinct leaf characters of mosaic, the vines were dwarfed and being without melons, were worthless.

Root knot caused by Heterodera radicicola (Greef.) Müll. was observed at Summerville, South Carolina, May 20.

Leaf spots caused by Alternaria brassicae nigrescens Pegl. did slight injury in Indiana. Another leaf spot caused by Cercospora citrullina Cke. resulted in 1% loss in Texas.

Rhizoctonia on watermelon is reported as a new disease in Washington Agricultural Experiment Station Bulletin 167, 1922, by F. D. Heald.

Thielavia basicola (B. & Br.) Zopf. on watermelon is dealt with by McKay in an abstract in Phytopath. 12: 445. 1922.

A wilt (cause undetermined) was mentioned by Barss - "A great deal of complaint about watermelon and cantaloupe wilt in Willamette Valley and southern Oregon. Considerable damage reported in Douglas County on watermelon."

Drought injury was recorded by Dana of Washington.

"Hail injury upon young fruit prevented maturing in some sections of Delaware and reduced marketable value." (Adams)

An interesting case of abnormal proliferated blossoms is reported by Taubenhaus of Texas. No causal agent is assigned.

General reference

Orton, W. A. and F. C. Meier. Diseases of watermelons. U. S. Dept. Agr. Farmers' Bul. 1277: 1-31. 1922.

DISEASES OF COTTON

Anthracnose caused by Glomerella gossypii (Southw.) Edg.

The reports of 1922, as compared with those of the previous two seasons, show that anthracnose was less destructive than usual. It seemed to be fairly uniformly distributed over the cotton area. The injury resulted from spotted bolls producing infected seed and a poor grade of line. The following report from Mississippi by Neal is characteristic of the general situation in other states.

> "A serious outbreak of the disease has been reported from Neshoba, Clarke, Lee and Hinds Counties." (September 1)
>
> "Although not as widespread as in former years, a few localities reported serious outbreaks of the disease."

(See also Pl. Dis. Bul. 6: 109, 147, 153. 1922)

Table 51. Prevalence and importance of cotton anthracnose in 1922

State	% loss	Remarks
South Carolina	1	Comparatively unimportant
Georgia	1	
Florida		Did no great damage
Mississippi	2	Prevalent in many parts
Louisiana	3	Abundant
Texas	.5	Traces - unimportant
Arkansas	.5	Little importance
Tennessee	2	

The earliest appearance of the disease was during July in Mississippi and Louisiana; August 15, in South Carolina, and in September in Arkansas.

No differences in varietal susceptibility were suggested nor were control measures mentioned.

Wilt caused by Fusarium vasinfectum Atk.

Wilt is one of the most serious diseases of cotton, having been reported in the past from nearly every cotton-producing state. During 19 reports were received from seven of these states. The amount of wilt was same, or possibly less than usual.

Table 52. Prevalence and importance of cotton wilt in 1922, accor to collaborators.

State	Percentage loss	Remarks
South Carolina	5	General over state, more than usual.
Georgia	2	Mostly in coastal plain section.
Mississippi	5	Reported from practically all over the state.
Louisiana	2	Common, but not so serious as usual.
Texas	3	Prevalent in light sandy soils.
Oklahoma		Reported in Carter County.
Arkansas	5	Less. Little resistant cotton grown.

Table 53. Dates of earliest appearance of cotton wilt in the United States in 1922, according to Plant Disease Survey collaborators.

Date	Place	Date	Place
April	Scott, Arkansas	June	Louisiana
June 6	Olav, South Carolina	July 7	Greenville, Mississippi

Control

The use of resistant varieties is the only proven method for the control of wilt. Elliott and Crawford (1) recommend that seed from infected fields should not be used for planting. Rast (2) obtained very promising preliminary results by heavy applications of potash fertilizers. These are to be repeated.

South Carolina: Estimated yield reduction partly accounted for by fact that lower yielding varieties must be raised on infested soil. (Ludwig)

Georgia: Use of wilt resistant varieties where rotation is practiced has largely done away with injury from this source. (Childs)

Mississippi: Delta type Webber was quite susceptible in Delta parts this season. Del Tos and Express 350 are fairly resistant. These are largely planted in the Delta. The resistant hill cottons largely planted are Lewis 63, TriCook, Trice and Covington Toole. (Neal)

References
(Cited)

1. Diseases of plants. Arkansas Sta. Bul. 181: 88-94. 1922.
2. Rast, L. E. Control of cotton wilt by the use of potash fertilizers. Jour. Amer. Soc. Agron. 14: 222-224. Sept. 15, 1922.

Angular leaf spot caused by Bacterium malvacearum EFS

Angular leaf spot, though common, was of much less importance than either wilt or anthracnose, except possibly in Georgia and Arizona where the disease caused heavy losses.

Table 54. Prevalence and importance of angular leaf spot in 1922.

State	% loss	Remarks
South Carolina	Trace	General - unimportant
Georgia	3	
Tennessee	1	
Florida		Abundant in western part of state
Mississippi	1	Same - unimportant
Louisiana	1	Common as usual
Arkansas	1	Less

State	% loss	Remarks
Texas	2	Severe in some localities
Missouri		One report, occurrence general
Arizona	5-10	

(See also Pl. Dis. Bul. 6: 63, 109, 147, 138-139. 1922)

The nature of the injury included defoliation, black-arm, shedding, boll rot, and lint stain.

The dates of earliest appearance were given as follows: Bamberg, South Carolina, June 6; Louisiana, July 20; Scott, Arkansas, April; Caruthersville, Missouri, July 11; and Arizona, April 20.

Control measures

The following two reports on the control of cotton angular leaf spot are given by Elliott of Arkansas, and Brown of Arizona, respectively:

> "Acid delinting gives practically 100% control. Very little boll spotting this year due to drouth."

> "Sulphuric acid seed treatment almost entirely eliminates the disease."

References

Brown, J. G. Black-arm of cotton: a successful method of control. Arizona Agr. Exp. Sta. Timely Hints 142: 1-8. Oct. 20, 1922.

Welles, C. G. Identification of bacteria pathogenic to plants previously reported from the Philippine Islands. Philipp. Jour. Sci. 20: 279-285. Mar. 1922.

Texas root rot caused by Ozonium omnivorum Shear

The Texas root rot was reported from Texas and Arizona, in both states of which it caused much injury. The weather retarded its progress, so that the loss was not so heavy as in 1921.

Specimens of diseased cotton plants were sent from Mexico by **Mr. W.** Ohlendorf of the Federal Horticultural Board to J. J. Taubenhaus, who determined the disease as Ozonium omnivorum.

Life history of fungus

> "It was found that the fungus does not live over in the soil, nor on decaying organic matter, but that it requires a living root on which to pass the winter. Roots of cotton plants, wild morning glory, castor bean, okra, pepper, and probably many others afford a root host on which the Ozonium winters over. Successful inoculations were also reported for the first time, using Ozonium omnivorum and successfully infecting healthy cotton plants." (Taubenhaus, J. J. Abst. Atlanta meeting Feb. 20-22, 1922. Phytopath. 12: 250-252. 1922)

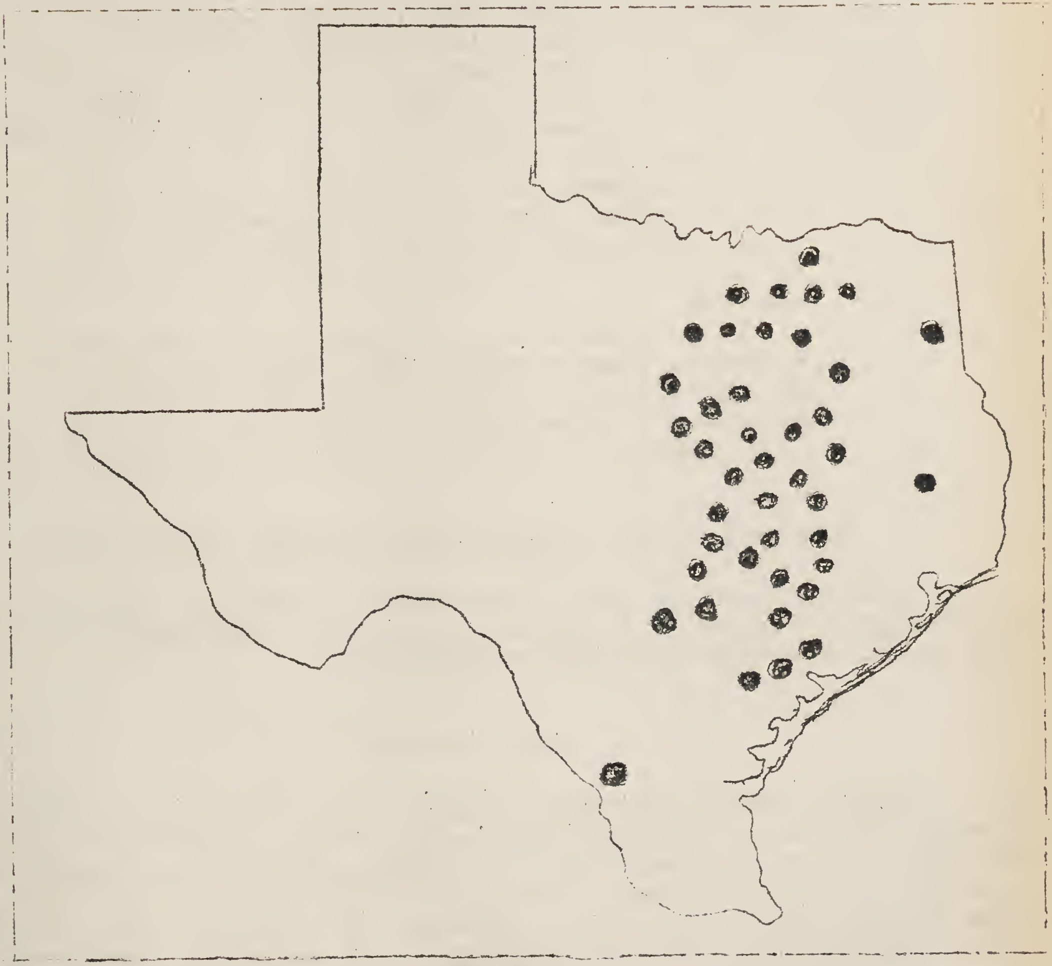


Fig. 10. Counties from which Texas root rot is reported by Taubenhaus.

Control methods

> "In connection with the work at the San Antonio Experiment Farm, investigations were carried on for determining the value of fertilizers for the control of root rot in cotton. Results showed no effect in preventing the disease under the prevailing conditions. .... Any beneficial effects of aeration were found to be of very short duration. Root rot was determined as occurring to a depth of at least 4 ft. Mulching had no effect on the control of the disease." (G. T. Ratliffe. U. S. Dept. Agr. Dept. Circ. 209: 32-33. 1922)
>
> "The causal organism winters over on living roots of susceptible hosts.

> "Deep fall plowing does not control root rot because such a practice does not necessarily kill the cotton roots; neither does it always destroy the susceptible weeds, especially the small flowered pink morning glory, *Ipomoea trichocarpa*, which is so common in the black lands of Texas.
>
> "Likewise, crop rotation does not control root rot even though a three- or four-year system is adopted in which non-susceptible crops are grown. In this case, the failure at control is due to the fact that the causal organism is permitted to live over during the fall and winter months on roots of perennial weeds which are commonly found on the stubble land of the grain or cereal crops which are used in the system of rotation.
>
> "It is possible to control root rot by fall plowing or crop rotation provided clean culture is practiced not only during the growing season, but also during the fall and winter months. (Taubenhaus, J. J. and D. T. Killough. (Abstract) Phytopath. 13: 33. Jan. 1923)

Root knot caused by *Heterodera radicicola* (Greef.) Müll.

Although root knot was reported only from Georgia, South Carolina, Mississippi and Arkansas, the disease is widespread throughout the South and serious on cotton especially on sandy soils.

Other diseases

Blight caused by *Ascochyta gossypii* Sydow did some injury in Logan County, Arkansas but was checked by the dry weather. Elliott has published the following articles regarding this disease during the past year: "A new Ascochyta disease of cotton." Arkansas Agr. Exp. Sta. Bul. 178: 1-18. 1922. "The Ascochyta blight of cotton." Phytopath. 12: 250-252. 1922.

Rust caused by *Aecidium gossypii* E. & E. caused .5% loss in the Rio Grande Valley of Texas, and was found in one district of about 300 acres in Arizona. The loss was negligible.

Leaf spot caused by *Cercospora gossypina* Cke. Traces were observed by Taubenhaus in Texas.

Leaf spot caused by *Alternaria* sp. was present in all the cotton districts of Arizona.

Various boll rots were mentioned. Edgerton of Louisiana lists *Olpitrichum carpophilum* Atk. as being rather common. It was also collected by Wolf in North Carolina. Other organisms in Louisiana, Texas and Arkansas were *Colletotrichum* sp., *Diplodia gossypina* Cke., *Fusarium* sp., etc. In Arkansas there was much less boll rot than usual.

Sore shin caused by *Rhizoctonia* sp. was commented upon by Robert Stratton (Oklahoma) as follows:

> "Sore-shin of cotton was very bad in some fields this year affecting young plants and destroying some fields in just a few days."

Sooty mold (cause not determined) did some damage in Arkansas on dusted cotton following honey-dew secretions by aphids. The lint was blackened and its grade lowered.

"Sunburn more than ordinary, especially on bolls blackened by sooty mold. In many cases boll rots have followed the sunburn injury." (Elliott, Arkansas)

Potash hunger, according to reports, was very evident both in Mississippi and Arkansas in 1922. It is present every year in the cotton area and so common that most pathologists fail to make mention of it.

DISEASES OF SUGAR CANE

Mosaic

Mosaic evidently is increasing both in importance and in its geographical distribution. Reports were received from Florida, Georgia, Mississippi and Louisiana. It had previously been reported also from Alabama. According to the statement of Brandes (Pl. Dis. Bul. Suppl. 22: 387. 1922), the above five states include the entire area where mosaic has been recorded in the United States.

Louisiana: Becoming abundant in all sections of the sugar belt. (Edgerton)

Georgia: Loss of 30 to 40% in green and red cane in yield of syrup per acre. "Cayana 10" variety is 100% resistant and now comprises 50% of acreage in Grady County. (J. B. Wright)

Florida: Mosaic was prevalent in the western part of the state. On account of the prevalence of this disease the State Plant Board had to quarantine this region. (Burger)

Varietal susceptibility

A resistant variety of cane known as Kavangire has been discovered. This variety is grown commercially in Argentine and a large amount of seed cane was shipped from there to Porto Rico under the direction of the Bureau of Plant Industry. It has given such good results on the Island that the acreage planted to it is increasing rapidly. Other varieties immune to the mosaic disease have been found, but they are the slender long-season varieties not suited to growing for sugar production in the United States. (See U. S. Dept. Agr. Clip Sheet No. 227. Oct. 30, 1922)

References

Brock, J. A. Cause of mosaic disease discovered by science. Facts About Sugar 16: 14-15. Jan. 6, 1923.

Bruner, S. C. Sobre la transmission de la enfermedad del "mosaico" o "rayas amarillas" en la caña de azúcar. Rev. Agr. Com. y Trab. Cuba 5: 10-22. Mar. 1922.

Chardon, C. E. and R. A. Veve. The transmission of cane mosaic. Facts About Sugar 15: 281, 283-284. Sept. 30, 1922.

Chardon, C. E. and R. A. Veve. Sobre la transmision del matizado de la caña por medio de insectos. Rev. Agr. Puerto Rico 9: 9-20. Aug. 1922.

——— The transmission of sugar cane mosaic by _Aphis maidis_ under field conditions in Porto Rico. Phytopath. 13: 24-29. 1923.

Lee, H. A. and E. W. Kopke. Mosaic disease of sugar cane in the Philippines. Philipp. Agr. Rev. 14: 418-421. 1922.

Matz, Julius. Recientas investigaziones en el estudio de la naturaleza del mosaico de la caña de azúcar y otras plantas. Rev. Agr. Puerto Rico 99: 9-12. 1922.

Simonetto, Moisés. Las rayas amarillas en la caña. Réplica al Dr. S. C. Bruner. Sugar 24: 641-642. Nov. 1922.

——— La enfermedad de las rayas amarillas en la caña (su importacion y extension, año y medio de observaciones en Cuba) Bol. Of. Sanidad Veg. Sec. Agr. Com. y Trab. Cuba 3: 1-63. May 1921.

——— Réplica al Dr. S. C. Bruner. La enfermedad de las rayas amarillas en la caña deazúcar. Rev. Agr. Com. y Trab. Cuba 5^{4}: 11-13, 44-48. 1922.

Veve, R. A. The efficiency of the "roguing" method for the eradication of the mottling disease. Results obtained by the Fajardo Sugar Company of Porto Rico. Louisiana Planter and Sugar Manufacturer 69^{2}: 30. July 8, 1922. (Will probably give good results in places where infection is less than 15%.)

Yoder, P. A. Pests and diseases of sugar cane -- The mosaic disease, its appearance and control. Facts About Sugar 15: 462-463. Dec. 2, 1922.

Anon. Gelestrepenziekte. Arch. Suikerind. Ned. Indië 30: 357-364. May 1922.

Red rot caused by _Colletotrichum falcatum_ Went.

Red rot was found in Georgia, Florida and Louisiana. J. B. Wright of Georgia stated that there was a loss of 10% in the seed beds of cane carried over the winter for planting. Burger, of Florida Agricultural Experiment Station, makes the following statement:

> "Red rot was prevalent in all the sugar cane districts this past year. In several cases the origin of the disease was traced to a certain locality which was badly infected and making a business of selling their cane for seed purposes."

Edgerton estimated the loss in Louisiana as 2 to 3%.

Control measures

The following measures are recommended by Burger (1) in controlling red rot:

> "In order to control this rapidly spreading disease:
> "1. Plant only healthy canes...........
> "2. As an extra preventive dip the canes selected

> for seed into Bordeaux mixture just before planting...
>
> "3. Whenever possible plant the canes in the fall instead of bedding them for spring planting.......
>
> "4. A method of dealing with the disease that has been practiced in the West Indies is to plant some other variety not subject to red rot.
>
> "5. Burn all trash in the old bed and all diseased cane."

References
(cited)
1. Burger, O. F. Red rot of sugar cane. Citrus Industry 3^2: 21. Feb. 1921.

(Not cited)
Yoder, P. A. Some insect pests and diseases of the sugar cane and methods of combating them. Sugar cane culture for syrup XII. Facts About Sugar 15: 402-403. Nov. 11, 1922.

Root rot caused by Marasmius plicatus Wak.

The following quotation from P. A. Yoder's article in Facts About Sugar 15: 402-405. November 11, 1922, is interesting:

> "Root rot while not a very aggressive parasite, sometimes does considerable damage to the growing crop of cane, especially during damp weather, either alone or in conjunction with other parasites. This fungus usually develops on the shaded part of the stalk near the ground. In its earlier stages, and during wet weather, it can be detected as a slimy formation between the leaf sheaths and the stalk near the ground. Later, as the cane approaches maturity, and during dry weather, the slime dries up and these lower leaf sheaths become cemented to the stalk with a white mold."

It was reported in 1922 only from Louisiana where it caused heavy loss in the more poorly drained sections, the percentage being estimated as 5 to 10% by Edgerton.

Other diseases

Leaf spot caused by Cercospora vaginae Kr. was reported as occurring generally in Florida.

White band is reported by O. F. Burger from Florida as follows:

> "White band of cane was reported from several districts. This is a condition of the leaf represented by a white band 2 inches wide extending across the leaf. The cause for this is not known. Some express the opinion that it is frost."

General references on sugar cane diseases

Ashby, S. F. Three major cane diseases (concl.). Agr. News 21: 78-79. Mar. 4, 1922.

__________ A Formosa sugar cane disease. Sugar 24: 619. Nov. 1922.

Lee, H. A., C. G. Welles and M. G. Medalla. Fiji disease of sugar cane in the Philippines. Philipp. Agr. Rev. 14: 413-417. 1922.

Lee, H. A. and M. G. Medalla. The season's experiments on Fiji disease, mosaic disease and smut of sugar cane. Philipp. Agr. Rev. 14: 402-412. 1922.

McWhorter, F. P. The nature of the organism found in the Fiji galls of sugar cane. Philippine Agr. 11: 103-111. Nov. 1922.

Matz, Julius. La enfermedad de la gumosis de la cana de azucar. Rev. Agr. Puerto Rico 9^3: 11-14. Sept. 1922.

__________ Observaciones sobre la gomosis de la cana en Puerto Rico. Rev. Agr. Puerto Rico 8: 5-13. Apr. 1922.

__________ The gumming disease of sugar cane. Its distribution and present status in Porto Rico - methods of transmission and means of control. Facts About Sugar 15: 238-259. Sept. 23, 1922.

Reinking, Otto A. Fiji disease of cane. Facts About Sugar 12: 272-273. 1921.

Weston, Wm. H. Jr. The production of conidia at night in species of Sclerospora. (Abstract) Phytopath. 13: 34. Jan. 1923.

Yoder, P. A. Some insect pests and diseases of the sugar cane and methods of combating them. Sugar cane culture for syrup XII. Facts About Sugar 15: 402-403, 405. Nov. 11, 1922.

Anon. The "Fiji disease" of sugar-cane. Jour. Dept. Agr. Union of South Africa 2: 554-556. 1921.

DISEASES OF SUGAR BEETS

Leaf spot caused by Cercospora beticola Sacc.

The leaf spot was about the same as usual in its severity, although in Kansas, Stokdyk reports 10% injury and in Utah, Richards stated that the disease is becoming more widespread. It was reported this season from Michigan, Iowa, Wisconsin, Kansas and Utah. In the past it has been reported from every state where sugar beets are grown commercially, although it has never been so severe in the western sugar beet states as it has been in the central and north central states.

Michigan: Occasional fields reported badly blighted. In nearly all cases this was associated with failure to rotate crops. (Div. of Bot. M. A. C.)

Wisconsin: Found in every field, but not enough to cause loss. Found more in low spots. (Vaughan)

Utah: Severity about as last year, but becoming more widespread. Still confined to Provo and closely surrounding districts. A loss but no definite percentage determined. (Richards)

Control

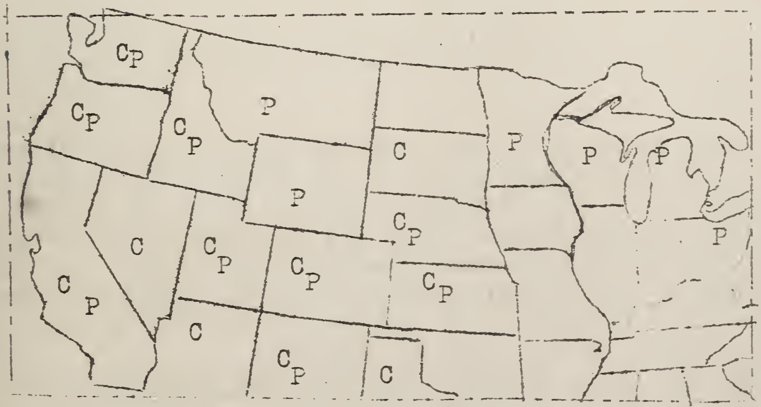
Kansas: Some injury this year, perhaps 10%. Spraying with Bordeaux mixture seems to be checking it to some extent. Complete records not available at this time. (E. A. Stokdyk)

Colorado: Appeared later than usual, hence did less damage. Spraying with bordeaux distinctly checked the disease. (C. O. Townsend)

Curly top (cause not determined)

Curly top in the past has been reported from the following western states: Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Colorado, New Mexico, South Dakota, Nebraska, Kansas, and Texas. The 1922 reports came only from California, Idaho and Kansas. In the last named state the injury was not serious and in Idaho, Hungerford estimated the loss at 3%. It was severe in some fields but not general in Utah and Colorado in 1922. Eubanks Carsner, in a letter January 7, 1922 from California, wrote:

> "In regard to curly top I may say that in general my impression is that the damage was less in 1921 than in the preceding season and very much less than in 1919. Notwithstanding this fact there was a great deal of the disease present. One of the sugar companies informed me that in their most inland region of one of the coastal valleys, 3000 acres were ploughed out before thinning because of the amount of disease, and the number of leafhoppers present indicated that the crop would not be worth harvesting. It may be of interest to note in this connection that sugar beet growing has been practically limited to the cooler coastal districts by the enormous amount of damage caused by curly-top in the interior districts."



C=States from which curly top of sugar beets has been reported.

P=States from which *Phoma betae* has been reported.

Fig. 11. Distribution of curly top and *Phoma betae* on sugar beets. Taken from the data available (up to and including 1922) in the files of the Plant Disease Survey Office.

Scab caused by Actinomyces scabies (Thax.) Güssow, was mentioned in reports as follows:

> Ohio: Presence of the disease noted in many localities. An economic factor in only two fields. (R. C. Thomas)
>
> Utah and Idaho: Some beets from Clearfield, Utah, have been diagnosed and scab reported. I do not know how extensive this condition is but it is probably limited. However, we have indications of some in Idaho. (Dean A. Pack)

Crown gall caused by Bacterium tumefaciens EFS & Town. was reported several times from Paulding County, Ohio. The disease was of no economic importance.

Mosaic (cause undetermined) was found doing slight injury in Indiana and Kansas.

Phoma rot caused by Phoma betae (Oud.) Fr. was not so prevalent in Idaho and Utah as usual. The severity of the disease apparently is correlated with the temperature and rainfall. Richards (Phytopath. 12: 443. 1922) says:

> "During the past season of 1921 a definite late blight of the sugarbeet became seriously epidemic throughout the northern part of Utah and southern Idaho. In Cache Valley, with a total acreage of 27,456 acres, 50 percent of the fields were diseased. The disease in the field varied in severity from a fraction of 1 percent of the beets destroyed to a total destruction of the crop. Many fields in the district were left unharvested, while others scarcely paid the expense of digging. The loss in the valley alone aggregated approximately two-thirds of a million dollars.
>
> "The available evidence indicates that the trouble is possibly identical with Phoma root-rot described by Edson and by various European workers. Data obtained from a study of this and similar but less severe epidemics of the disease in the Logan factory district during 1917 to 1919, show that such epidemics are favored by drought, and locally at least, are closely correlated with abnormally low precipitation during the months of June and July."

Crown rot caused by Rhizoctonia sp. was observed in Wisconsin. It was present in low, wet fields of Dodge County where in one field a third of the plants showed rot. A trace of a similar trouble, reported under the term heart rot, was noted in Iowa. Still another name, dry rot canker, was used in Cache County, Utah, where the trouble was less important than in 1920 and 1921.

Considerable loss due to damping-off caused by Pythium debaryanum, was produced in the Ohio sugar beet district. The disease was favored by the extreme wet weather in the spring season. (R. C. Thomas)

Seedling rots caused by Phoma, Pythium, and Corticium vagum were very serious in a number of fields in certain sugar beet areas. They, however, were less than in 1921. As high as 82% infection was determined during the spring in Utah. Such fields were usually plowed up, re-seeded or sown to other crops. The actual reduction in yield from this disease is difficult to determine as indirect effects are so numerous. It is hoped that another year will yield results on this point. (B. L. Richards)

DISEASES OF TOBACCO

Wildfire caused by Bacterium tabacum Wolf & Foster

The first report of wildfire came from North Carolina in 1917. Since then, as the Plant Disease Survey records show, it has spread in the manner its name would indicate. Each succeeding year new states or new counties were invaded, at least the disease was observed in them for the first time. In 1922 it was found in three new states - New Hampshire, New York and Florida - and was recorded in three additional counties in South Carolina,- namely, Georgetown, Clarendon and Aiken. It is now present in sixteen states.

Table 55. Prevalence and importance of wildfire in 1922.

State	Prevalence and importance
Massachusetts	Extremely serious
New Hampshire	Present
Connecticut	Present, less than last year
Pennsylvania	In Lancaster County - worse than in 1921 - loss 2%
New York	Serious on some Chemung County farms - loss 1-2%
Maryland	Serious in Prince Georges County on individual farms
Virginia	Possibly present
Kentucky	In 8% of the fields examined
South Carolina	More generally distributed than last year
Georgia	Reported from Tifton - not serious
Florida	In Gadsden County several fields
Wisconsin	90 farms in Dane County - estimated loss $500

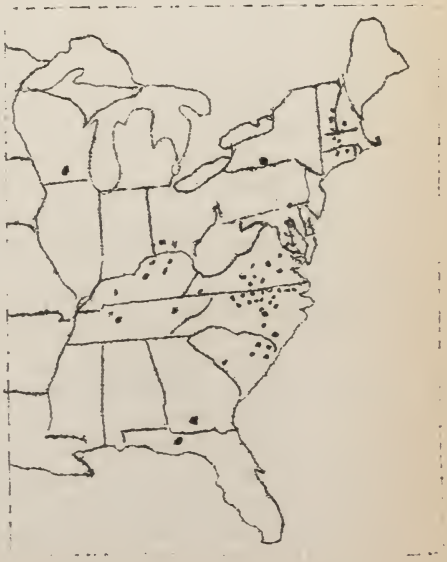


Fig. 12. Distribution of wildfire of tobacco. Dots represent counties. Data obtained from all Plant Disease Survey reports, including 1922.

Connecticut: Has now appeared in all the tobacco regions of the state being found for the first time this year in Fairfield, Litchfield, (southeastern part) and Middlesex counties. (Clinton)

Maryland: Caused almost a total loss last spring and fields set with plants from infected beds are now showing as much as 40% financial loss. (Temple & Jehle, Sept. 15)

Virginia: Of 85 plant beds and 150 fields inspected not one case of wildfire was seen. No authentic reports received. I cannot believe that it has disappeared entirely from the state. It may have been present to a slight extent in the counties which were not visited by men from the department. (Fromme)

North Carolina: It is impossible to give any satisfactory estimate of the losses caused by wildfire. During 1917 (the first year the disease was definitely recognized) it was universally conceded by growers that this disease is the most destructive one which attacks tobacco. Losses, ranging from those which were inappreciable to those in which almost the entire crop was destroyed, were sustained in every locality where the disease was present. The problem of estimating the damage wrought is further complicated by the fact that in some sections the disease occurred on every farm, whereas in others it was present only in an occasional field. This lack of uniformity in destructiveness occurred also on the same farm, since certain fields were badly affected while others had little or none of the disease.

In 1918 wildfire was less prevalent than in 1917, and in none of the succeeding years has it been regarded as a trouble of major importance. In fact, it has appeared only in isolated areas and was confined to a few fields in any locality. It is interesting in this connection to note that no wildfire occurred during 1922 on the farms where the disease was first observed. The cause of this decrease in destructiveness and apparent disappearance of wildfire is not adequately known, but is a phenomenon which has been recorded in the case of a number of other plant diseases. (F. A. Wolf (2))

Florida: Wildfire was found in two small plant beds and three two-acre fields. One field was discovered ten days after the plants were set when about 60% of the plants were infected. All plants were pulled and burned and the field reset ten days later with healthy plants. Only one center of infection developed during the season. Other two fields were a total loss when discovered on June 12. All plants in one field were cut near ground and carried out of field. About 50% of stumps developed suckers, but these plants remained practically free from infection, and grew to good size although leaves were undersized. (W. B. Tisdale)

South Africa: Wildfire and angular spot in tobacco has been causing considerable anxiety amongst tobacco growers, and appears to be spreading rapidly. During the season 1920-21, this disease was only reported from the Government experiment stations at Rustenburg and Piet. Retief, from certain farms in the Piet Retief District, and one in the Rustenburg District. During the present season specimens have been identified from three more farms within fifty miles of Rustenburg, and also from Groot Marico and from Swaziland. (Wildfire and angular spot in tobacco. Jour. Dept. Agr. South Africa 4: 117. Feb. 1922)

(See also Pl. Dis. Bul. 6: 21, 40-41, 62-63, 97, 114, 139. 1922)

The earliest recorded appearances of wildfire in 1922 were - March 7 (Hensdale, New Hampshire), May 7 (Connecticut), May 25 (Hadley, Massachusetts), June 13 (Hemingway, South Carolina), and June (Dane County, Wisconsin).

Control measures

The following measures are recommended by P. J. Anderson (1):

> "On five successive crops of tobacco seedlings in the Experiment Station beds wildfire was reduced to an average of not over one percent by spraying or dusting the beds with a copper fungicide. The percentage of infection on the controls varied from 20 to 92. Copper lime dust, Bordeaux mixture and various commercial fungicides were all about equally effective. No definite interval between applications can be established, but they must be sufficiently frequent to keep the leaves covered at all times. Dusting is more expensive than spraying but is more rapid and more popular with the growers. Growers who used enough fungicide and applied it frequently enough were successful in keeping the beds clean."

References:
(Cited)
1. Anderson, P. J. Controlling tobacco wildfire in the seed-bed. Phytopath. 13: 59. 1923.
2. Wolf, F. A. Wildfire of tobacco. North Carolina Agr. Exp. Sta. Bul. 246: 1-26. 1922.

(Not cited)
Clinton, G. P. and F. A. McCormick. Wildfire of tobacco in Connecticut. Conn. Agr. Exp. Sta. Bul. 239: 365-423. May 1922.
Fromme, F. D. and S. A. Wingard. Blackfire and wildfire of tobacco and their control. Virginia Agr. Exp. Sta. Bul. 228: 1-19. April 1922.
Johnson, James and S. B. Fracker. Tobacco wildfire in Wisconsin. Wisc. Agr. Exp. Sta. Bul. 348: 1-21. 1922.
Tisdale, W. B. Tobacco diseases in Gadsden County in 1922 with suggestions for their prevention and control. Florida Agr. Exp. Sta. Bul. 166: 1-118. Dec. 1922.

Angular-spot or blackfire caused by Bacterium angulatum Fromme & Murray

Angular-spot evidently is spreading to additional territory, for in 1922 it was reported from Connecticut and South Carolina, two states where it had not been definitely determined before. Prior to 1920 it had been reported only from Virginia where it was first noticed in 1917. It is now known to occur in Massachusetts, Virginia, Kentucky, South Carolina, Texas, North Carolina, Indiana and possibly Connecticut and Ohio. It is also said to be present in South Africa.

Connecticut: Seen for first time, 20 or more fields. Found so far chiefly in Housatonic Valley. Am not sure of the cause as we have not produced it by inoculation as yet. Fairly serious. (Clinton)

Virginia: The disease was not epidemic in any section although severe losses were seen in occasional fields. In all about 200 fields were examined in the counties of Henry, Pittsylvania, Charlotte, Prince Edward, Bedford and Amherst. The disease was found in 40% of these fields. The losses as a whole were slight; in fully 60% the loss did not exceed 1%. The loss for the state as a whole is estimated at 3%. Infection was more common in Charlotte County than in any other visited and least prevalent in Pittsylvania. In the Chatham section of the latter county there was practically no blackfire. This section was especially hard hit by the drought of last year, 1921, and it is thought that this is the most important factor in the general freedom from disease this year, since the dry weather did not permit infection of the seed capsules. The same conditions also operated to some extent over the state as a whole. Seed treatment and plantbed sanitation practices also played some part in the general reduction in severity of disease. There were 85 plantbeds inspected in the counties of Charlotte, Bedford and Amherst and blackfire was found in 22, or 26%. Our figures show that at least 2248 farmers used treated seed in 1922. No doubt the number was much greater since we do not have complete records. (Fromme)

Table 56. Prevalence of angular-spot of tobacco in 1922, as reported to the Plant Disease Survey by collaborators.

State	Prevalence of angular-spot
Massachusetts	Not serious, relatively few cases.
Connecticut	Not sure that it is the disease - first report July 31, New Milford, 3% loss.
Virginia	Severe losses in occasional fields.
Kentucky	Present in over half the fields.
South Carolina	Recorded for the first time in the state on June 2 at Paxville.

(See also Pl. Dis. Bul. 6: 63, 83, 96. 1922)

References:

Fromme, F. D. and S. A. Wingard. Blackfire and wildfire of tobacco and their control. Virginia Agr. Exp. Sta. Bul. 228: 1-19. Apr. 1922.

________________ Blackfire or angular-leafspot of tobacco. Virginia Agr. Exp. Sta. Tech. Bul. 25: 1-13. Apr. 1922.

Black root rot caused by Thielavia basicola (B. & Br.) Zopf.

Black root rot caused unusually heavy losses this season.

Table 57. Prevalence of black root rot in the U. S. during 1922, according to Plant Disease Survey collaborators.

State	Prevalence and importance - 1922
Massachusetts	Serious in a few fields.
Connecticut	More on the earlier set tobacco.
Virginia	Caused considerable complaint.
Kentucky	15% loss in Burley section - inspected 76 fields.
Florida	Present throughout Gadsden County.
Ohio	Considerable in plant beds.
Wisconsin	More than usual,- 15% loss. Resistant strains used in some cases.

Virginia: This disease was also prevalent and the cause of considerable complaint in some sections especially in Bedford and Charlotte Counties. It is usually found in rather well defined areas in the fields and is especially apt to occur where cowpeas or soybeans have preceded tobacco. Loss about 1%. (Fromme)

Florida: Root rot was prevalent throughout the county of Gadsden this year and caused damage varying from slight or unnoticeable stunting to more than 50% loss. Heavy rains favored attack. (W. B. Tisdale)

(See also. Pl. Dis. Bul. 6: 63, 97, 113, 140. 1922)

Varietal susceptibility

Kentucky: About 300 lots of experiment station resistant strains of Stand-up Burley tested on farms. Results very promising. At least four men raised seed in quantity for sale, for 1923 crop. First year I have observed root rot causing loss in dark sections. (Valleau)

Florida: It was quite evident that plants which were attacked by root rot were also badly attacked by frogeye or specking. The Connecticut Round Tip proved to be highly resistant to root rot. (W. B. Tisdale)

> "An account is given of breeding experiments with tobacco to secure strains resistant to the root rot due to Thielavia basicola, and the authors describe strains of White Burley tobacco that are recommended for planting either on new land or old land that is known to be diseased." (Abstract in E.S.R. 47. Oct. 1922 (1))

> "Plantings of strains of tobacco made in 1920 and 1921 in soil infested with Thielavia basicola have shown marked resistance to root rot on the part of some of the strains, the more resistant ones yielding double the crop of the more susceptible ones." ((2) From Abstract in E.S.R. 47. Oct. 1922)

References
(cited)

1. Valleau, W. D. and E. J. Kinney. Strains of Stand-up White Burley tobacco resistant to root rot. Kentucky Agr. Exp. Sta. Circ. 28: 3-16. 1922.
2. Pennsylvania Sta. Bul. 170 (1922): 15-19, 19-20.

Mosaic

Mosaic is of much importance in some areas, as in Kentucky, where counts in 76 fields showed 8% loss, while in others it comes so late that the harvest is over before it has an opportunity to cause much loss. The relative prevalence over the whole tobacco growing area of the United States seems to be about the same from one year to another.

Table 58. Prevalence and importance of mosaic in 1922.

State	Prevalence and importance
Massachusetts	In Connecticut Valley. Much more than usual.
Connecticut	Average. In Hartford, New Haven, Litchfield and Fairfield Counties.
New York	Present.
Virginia	1-50% around Lynchburg. 1% loss.
Kentucky	Counts in 76 fields, 8% loss.
Florida	In only a few fields before harvest.
Ohio	Less prevalent, only of moderate importance.
Wisconsin	Secondary rusting caused most concern.
Quebec, Canada	Present.

Virginia: Mosaic was more prevalent than in previous years. It was found in 50% of fields and up to 50% of plants in these fields were affected. Mosaic losses are not so great on the types of tobacco grown here as on the finer leaf or wrapper tobacco. The farmer usually does not consider it a disease of importance, and attributes it to rainfall, fertilizer, topping, suckering and various other things. It is usually more prevalent on the tobacco plants that have been reset than on those of the first planting. It is frequently found on 100% of the suckers which are allowed to grow after the crop has been harvested. Loss for the state, 1%. (Fromme)

Kentucky: The relationship between mosaic of bull nettle, ground cherries (3 sp.) tomato and tobacco, has been proved the past summer by cross inoculations. It may be transferred readily from one plant to another. Inoculations from pokeweed, bean, soybean and clover to tobacco failed to produce mosaic. White fly has been found not to be a carrier of the mosaic of tobacco under greenhouse and field conditions.

It was observed that in sections where there is much available space for seed beds such as in the hilly sections of the state, tobacco mosaic is often difficult to find, whereas in the blue grass section where beds are usually planted near where tobacco has previously been grown it is very prevalent. A permanent tobacco bed steamed each year and in which perennial solanaceous weeds were nearly eradicated produced nearly a disease-free crop, but a burned bed used three years and with numerous solanaceous plants produced crop with initial infection of 9%. The disease does not seem to be carried into beds even from plants just outside of bed. A spray of oil on weeds, Physalis and bull nettle, in late August killed tops but most of them send out new shoots before late fall. Root stalks apparently not injured. (Valleau)

Florida: Mosaic appeared in only a few fields before the plants were topped and harvest begun. All suckers in practically every field become badly infected. It has occurred to me that this late infection might be due to the insects coming in after the growers quit dusting the plants. None of the growers consider the disease as serious. (W. B. Tisdale)

(See also Pl. Dis. Bul. 6: 63, 96, 114, 140. 1922)

James Johnson has made the following statement with regard to the results of experiments conducted by him, indicating the nature of the mosaic virus (1):

> "Chambers in which plants can be grown under controlled temperature and humidity conditions have been constructed. It has been found that the optimal temperature for the mosaic disease of tobacco lies close to 28-30°C. The maximal temperature for its expression is approximately 37°C., that is, at this temperature inoculated plants fail to develop symptoms, and leaves showing mosaic symptoms gradually 'recover'. Similar results may follow from low temperature exposure. Quantitative determinations of enzymes, said to cause mosaic, indicate that enzymes are not correspondingly reduced by exposure of plants to the higher or lower temperatures; in fact, it is probable that the optimal temperature for their activity lies close to 37°C. It seems, therefore, that these results furnish evidence against the enzymatic theory of mosaic while at same time they favor the parasitic hypothesis, since the temperature curve for the development of mosaic corresponds closely with that of the development of many of the plant pathogens."

References
(Cited)
1. Johnson, James. Experimental evidence relating to the nature of the mosaic virus. (Abstract) Phytopath. 12: 52. Jan. 1922.

(Not cited)
Dickson, B. T., and E. G. Hood. Temperature studies in mosaic diseases. (Abstract) Phytopath. 13: 42. Jan. 1923.
Dickson, B. T. Temperature studies in mosaic diseases. Phytopath. 13: 42. Jan. 1923.

Duggar, B. M. and J. L. Karrer. The sizes of the infective particles in the mosaic disease of tobacco. Ann. Missouri Bot. Gard. 8: 343-356. 1922.

Oliver, Lugo F. El mosaico del tabaco y como combatirlo. Rev. Agr. Puerto Rico. 10^1: 11-14. January 1923.

Palm, B. T. De mozaiekziekte van de tabak een chlamydozoonose. Bul. Deliproefst. Medan-Sumatra 15: 1-10. 1922.

Other diseases

Bacterial wilt caused by Bacterium solanacearum EFS was present in one 16-acre field in Gadsden County, Florida, reducing the yield about 10% (Tisdale), but in Virginia where it is usually present, it was not seen this season.

Leaf spot or frogeye caused by Cercospora nicotianae E. & E. became prevalent and in a few cases serious in Gadsden County, Florida, immediately following a rainy period. The disease was most serious in shades which were infested with Thielavia basicola, and the growth of the plants was checked by this fungus. The disease first appeared on the lowest leaves and advanced rapidly to those higher on the stem (W. B. Tisdale). Leaf spot was found also in South Carolina.

In Wisconsin there was an occasional occurrence of the Wisconsin leaf spot caused by an undescribed bacterium. The damage was negligible.

The following non-parasitic diseases have been reported:

Leaf spots - Wisconsin - Did not cause much concern.

Rust - Massachusetts and Connecticut - Fairly common.

Pole sweat - Massachusetts - Wet weather after harvest favored trouble, unusually serious.

Broad leaf spot - Massachusetts - Prevalent in most broad leaf fields.

Sand drown - (See Garner, W. W., J. E. McMurtrey, and E. G. Moss. Sand drown, a chlorosis of tobacco due to magnesium deficiency and the relation of sulphates and chloride of potassium to the disease. Jour. Agr. Res. 23: 27-40. Jan. 6, 1923; same authors, Science n.s. 56: 341-342. Sept. 22, 1922.)

Magnesium hunger - Connecticut - Not common.

Wind injury - Connecticut - in scattered fields.

Water injury- Connecticut - Excessive rains drowned tobacco in low fields.

Ring spot or hieroglyphics - Virginia, Kentucky, Ohio - Attempts at cross inoculations were made by Valleau in Kentucky. Inoculations were made by rubbing diseased plants with fingers, then rubbing healthy ones. Two infections were obtained out of about 200 attempts. The checks remained healthy. The disease caused considerable alarm among farmers in Virginia. It was there second in importance to black fire, causing about 2% loss for the state. It had been watched for several years and had not been considered of serious importance previously. (Fromme)

The following diseases, the cause of which has been at least partly determined, were reported:

Fusarium sp. in plant beds - Ohio (See Plant Disease Survey Bul. 6: 114. 1922).

Shoe string or frenching, often considered a type of mosaic, caused severe loss in one field in Virginia.

Leaf spot caused by *Phyllosticta* spp. was rather common in Virginia on seedlings in plant beds, especially those beds showing lack of fertility. It does not seem to persist in the field. (Fromme)

White speck attributed by R. C. Thomas to *Macrosporium tabacinum* E. & E. is present in Ohio, particularly in Brown County where there is a small heavily infested area. Clinton reports white speck from Connecticut and suggests that the cause may be physiological.

Brown spot caused by *Alternaria* sp. was also observed in Ohio.

Other common diseases were damping-off caused by *Pythium debaryanum* Hesse, and found to a very limited extent in Connecticut and Wisconsin; and root knot caused by *Heterodera radicicola* (Greef.) Müll. This latter disease resulted in 1% loss in South Carolina, and did considerable injury in some fields of Gadsden County, Florida. A root knot was also found at Alexandria, Kentucky, but no nematodes could be found associated with the swellings of the roots.

References

Garner, W. W. Tobacco culture. U. S. Dept. Agr. Farm. Bul. 571: 1-24. Rev. Oct. 1922. (Dec.)

Scherffius, W. H. The future of the tobacco industry in South Africa. Jour. Dept. Agr. Union South Africa 4: 224-227. 1922.

DISEASES OF MISCELLANEOUS VEGETABLE CROPS

ARTICHOKE

Botrytis rot on globe artichoke: "Although primarily a transit disease it begins in the field where the original contamination and frequently the original infection takes place. The fungus was found in the artichoke fields near Half Moon Bay, California. There, favored by heavy fogs and cool weather, the fungus grows and sporulates profusely. Lesions on the growing buds generally are to be ignored in harvesting and packing.

"The fungus causes very little rot at temperatures above 80°F., and practically none at 0 to 2°C., although it grows slightly on agar at 0°C. The rot progresses most rapidly at temperatures between 68 and 75°F., lesions 4-8 mm. in diameter developing within 24 hours after inoculation." (Link, Geo. K. K., G. B. Ramsey and Alice A. Bailey. (Abstract) Phytopath. 13: 58. Jan. 1923)

ASPARAGUS

Rust caused by *Puccinia asparagi* DC.

Asparagus rust is distributed over almost the entire United States, reports having been received during past years from every state but Florida, Utah, Nevada, Wyoming, Idaho and Montana. The losses incurred have been so much reduced since resistant varieties were introduced, that the disease is no longer an economic factor in many localities.

Table 59. Prevalence and importance of asparagus rust in 1922.

State	Prevalence Compared with: Last Year	Prevalence Compared with: Average Year	Remarks
Massachusetts		Same	Most serious in eastern part of state.
New York		Same	Present on susceptible varieties.
New Jersey			Severe in some fields in Cumberland Co.
Delaware		More	Very prevalent on Palmetto, - Bordeaux gave good results.
Texas			Trace.
Ohio	Same	Same	Destructive on susceptible varieties.
Indiana	More	More	Destructive locally.
Illinois	More	More	Appeared late,- trace of loss.
Minnesota	Same	Same	Not abundant.
Iowa		Same	Local,- 8% loss.
North Dakota	Less	Less	Not as prominent as in other years.
Missouri		Same	Present
Colorado			Present

Table 60. Dates of earliest appearance of asparagus rust in 1922.

Date	Place	Date	Place
May 28	Chisago Co., Minnesota	August 28	Vigo Co., Indiana
June	Monroe, New York	August	Wayne Co., Ohio
July 1	Wayne Co., Illinois	August	Fort Collins, Colorado
July 12	Cannon, Delaware		

A stem spot caused by Cercospora asparagi Sacc. was found on young seedling plants in Delaware. (Adams)

"Fusarium rot of asparagus shoots, presumably the same as that reported by Cook. (Mel. T. Cook. A new disease of asparagus. (Abstract) Phytopath. 12: 49. Jan. 1922) was received by the Office of Cotton, Truck and Forage Crop Disease Investigations from the following points in 1922: May 4, North Tarrytown, New York; and June 10, Hollisterville, Pennsylvania." (W. W. Gilbert)

A twig canker (cause undetermined) was collected in South Carolina. (Ludwig)

BEET (Garden)

Scab caused by Actinomyces scabies (Thax.) Güssow was reported from Massachusetts, New York, New Jersey, Ohio, Minnesota, North Dakota and Idaho. The reduction in market value was no more than a trace.

Leaf spot caused by Cercospora beticola Sacc. was reported from Vermont, Massachusetts, Connecticut, New York, New Jersey, Delaware, Florida, Louisiana, Texas, Ohio, Indiana, Illinois, Minnesota, North Dakota, and Colorado; and probably was present in other states. In most cases only slight injury resulted but in Marion and Lake Counties, Indiana, Gardner found severe infections; in New York, M. C. Hammond reported that there was considerable damage to plantings in the Warwick section of Orange County; in Larimer and Weld Counties, Colorado, it caused a death of the leaves which placed the crown higher when the new leaves came on about a month later (Learn); and in New Jersey the leaf spot was destructive both on garden and mangel beets. There was 100% of infection of the latter in a low wet area in Atlantic County. The leaves turned yellow and dropped. The part of the root above ground was also attacked.

Root knot caused by Heterodera radicicola (Greef) Müll. was the cause of 2% loss in Texas. (Taubenhaus)

A root disease caused by Rhizoctonia sp. was observed in Weld and Larimer Counties, Colorado. (Learn)

In Louisiana, wilt caused by Sclerotium rolfsii Sacc. affected patches of beets that went into the warm spring weather, the loss being as high as 50%. (Edgerton)

CARROT

Soft rot caused by Bacillus carotovorus Jones was present in Massachusetts, New York, New Jersey, and Colorado. E. E. Clayton of Long Island suggested that it was largely secondary to other troubles, especially leaf blight. In New Jersey it was pointed out that carrots are seldom attacked in the growing stage, but only after they are mature and left in the soil. Therefore, harvest should be made as early as storage conditions will permit.

Watery soft rot caused by Sclerotinia libertiana Fckl. resulted in slight injury in New Jersey and Louisiana. The rot was more common on densely crowded young plants, and in storage pits.

Leaf blight caused by Macrosporium carotae E. & L. was common in Massachusetts, New York, New Jersey, and Kansas. On Long Island the great loss consisted in making it impossible to sell carrots in bunches. (Clayton)

Black rot caused by Alternaria radicina Meier, Drechsler & Eddy has been described as a new storage rot of carrots. It was found in material from various points in New York, Massachusetts, and Pennsylvania and in Washington, D. C. It is thought that the disease is probably generally distributed throughout the carrot storage area of the eastern part of the country. (Meier, F. C., Charles Drechsler, and E. D. Eddy. Black rot of carrots caused by Alternaria radicina n. sp. Phytopath. 12: 157-166. Apr. 1922)

Leaf spot caused by Cercospora apii carotae Pass. was serious in market gardens in Indiana. (Gardner)

Nematodes were found in carrots in Washington.

The Rio Grande Valley disease (cause unknown, and which had previously been reported in lettuce), was recorded in Texas on carrot.

CELERY

Late blight caused by Septoria apii (Br. & Cav.) Chester

Late blight was much more destructive than usual in the eastern celery sections. This was evidently due to the heavy rainfalls. The infection was so abundant that many men who applied fungicides did not get satisfactory results in control. Evidently the first applications were not made until the disease began to show.

Table 61. Importance of late blight of celery in 1922, according to collaborators.

State	Remarks
Vermont	25% crop affected, loss slight.
Massachusetts	Much more - very severe - general.
Connecticut	Same amount as usual.
New York	5-10% loss, more than usual.
New Jersey	15% loss. Heavy loss in low wet areas.
Pennsylvania	15-40% reported - worse than usual.
Delaware	Same as usual. Bordeaux gave good control.
Ohio	Less than usual - severe in some fields.
Illinois	Trace. Abundant where Skinner irrigation system is used.
Michigan	Extremely severe in all regions.
Minnesota	Same as usual,- not of much importance.
Colorado	Unimportant.

New Jersey: A good many growers used anhydrous copper dust treatment this year, most of whom considered it worthless. (R. F. Poole)

New York: Careful spraying or dusting gave almost complete control. (Charles Chupp)

Septoria blight of celery has occurred only occasionally in the past five years that I have been associated with the celery situation in Western New York. Many fields this year are suffering severely with this blight. Septoria blight is general and destructive in many fields. (H. W. Dye)

On September 27 I examined the plantings of celery on the College farm which included fifty-four named varieties and about one hundred strains, considering a strain as a separate seed source. The late blight fungus was noted by the professor in charge of the variety test the week of September 4. At the time I visited the plots all the varieties and strains were badly infected. I could see no certain indication of resistance in any variety or strain, although Easy Blanching and one or two of the Rose varieties (Farquhar's Giant Red, also Meisch's Own Grown Green celery) appeared to be slightly less affected. No detailed counts were made on any of these. (H. E. Thomas)

(See also Pl. Dis. Bul. 6: 148-152. 1922)

Table 62. Dates of earliest appearance of late blight of celery in 1922.

Date	Place	Date	Place
July	Orange County, New York	September	Denver, Colorado
July 7	Ramsey County, Minnesota	September	Dover, Delaware
July 15	Bergen County, New Jersey	September 20	Ashland County, Ohio
August 22	Milford, Connecticut	September 25	Vermont

Early blight caused by Cercospora apii Fr.

Early blight was observed in Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, South Carolina, Florida, Ohio, and Indiana. It was not reported from Vermont or Michigan. The disease was distributed very unevenly in the different celery districts. In New York the late blight was the prevailing fungous disease, yet occasional isolated fields were injured severely by the Cercospora. In New Jersey early blight was found principally in the upland celery; in North Carolina it was important only locally; in Massachusetts and Delaware it was general but not destructive; and in Connecticut, Pennsylvania, Florida, Ohio and Indiana it was unusually destructive. The first infections were found July 15 in Bergen County, New Jersey, and at Calhoun, South Carolina. Other dates were August 1, Sanford, Florida; August 26, Stratford, Connecticut; September 4, Wilmington, Delaware; and September 15, Medina County, Ohio.

According to Jagger (Florida) losses from blight can largely be attributed to the carelessness in spraying. A. C. Foster (Florida) writes, "Controlled very effectively by constant spraying with liquid Bordeaux, 4-4-50, at the rate of 100 gallons to an acre every 7 to 10 days." R. F. Poole (New Jersey) verified this statement. "Splendid control has been produced with Bordeaux mixture." (See also Pl. Dis. Bul. 6: 148, 152-153. 1922)

Yellows caused by Fusarium sp.

Yellows seems to be increasing in its prevalence and geographic range, having been reported from New York, Pennsylvania, Indiana, Ohio, and Michigan. In Niagara County, New York, one man lost 100,000 plants because of this disease (Specimens were sent to Michigan for identification.). In Ohio it is gradually increasing, although it is not yet of sufficient importance to occasion serious concern (R. C. Thomas). In Pennsylvania, Beach found the disease in two localities causing 5% and 25% losses, respectively, on Golden Self Blanching celery. Coons and Nelson are still testing strains resistant to yellows. (Phytopath. 13: 56. 1923): "Seed production of Golden Self-Blanching Celery resistant to yellows (Fusarium sp.) was continued on a small scale in 1921 and about a pound of resistant seed is now available for increase. Testing concerned itself with comparing progenies of individual plants for disease resistance. The second generation plants from most isolations possess the same tolerance as the parents and have developed well in infested soil in which commercial seed has failed completely." (See also

Pl. Dis. Bul. Suppl. 22: 403-404. 1922.)

Bacterial leaf spot caused by Bacterium apii Jagger

Bacterial leaf spot was found in New York, Michigan and Ramsey County, Minnesota. This is the first report from Minnesota. It was prevalent in its usual amount in both New York (2-5% loss) and Michigan. Either spraying with Bordeaux mixture or dusting with copper-lime dust gave excellent control under New York conditions.

Black heart

Black heart (apparently physiological) is reported from Florida as follows:

> "I am quite certain that the so-called black heart they have in New Jersey and Pennsylvania is distinctly different from that found here. The black heart found in the East is a typical soft rot and decay evidently caused by Bacillus carotovorus or closely related forms, and the disease as found in Florida is non-parasitic, with decidedly different symptoms." (A. C. Foster)
>
> "Apparently a physiological browning and death of the edges of the leaves of the heart, brought about by too hot weather. Decay organisms usually gain entrance through the physiological lesions. Usually there is little or no trouble with heart rot until the weather changes from the comparatively cool weather of the winter to the warmer weather of the spring months, which usually occurs in March. There is always some loss from heart rot in the later celery." (Ivan C. Jagger)

Other diseases

Soft rot caused by Bacillus carotovorus Jones, resulted in heavy losses in Massachusetts and Pennsylvania, and slighter ones in New Jersey and Florida. R. F. Poole (New Jersey) stated that the Golden Self-blanching variety was the most susceptible but that the green varieties were also attacked. In Pennsylvania C. R. Orton also noticed that the easy Blanching varieties were the more susceptible.

Heart rot caused by bacteria was observed occasionally in Louisiana and did much damage in Delaware, according to collaborators.

Watery soft rot caused by Sclerotinia libertiana Fckl. was reported from Massachusetts, New York, New Jersey, Florida and Ohio. R. F. Poole (New Jersey) says: "This disease is known as foot rot in some fields, where it causes slight damage, especially to plants undergoing blanching with boards. It is very serious in some greenhouses, causing the loss of many seedling plants at a time when they are needed for resetting in the field." References: Poole, R. F. The Sclerotinia rot of celery. New Jersey Agr. Exp. Sta. Bul. 359: 5-27. 1922. Some recent investigations on the control of Sclerotinia libertiana in the greenhouse on the muck farms of Bergen County, New Jersey. Phytopath. 12: 16-20. Jan. 1922.

Root rot caused by Phoma apiicola Speg. is described from Michigan by C. W. Bennett in "A Phoma root rot of celery." (Michigan Agr. Exp. Sta. Tech. Bul. 53: 1-40. 1922.) The disease was not seen in Michigan during 1922.

Root rot and stem browning caused by Rhizoctonia sp. were noted in New York and Ohio.

Damping-off caused by various organisms, such as Pythium, Phytophthora, and possibly Sclerotinia was reported from Florida.

Mosaic was observed on the College Farm in New Jersey on several varieties, including both yellow and green celery. Nothing is known regarding its origin and relation to other hosts. The disease was transmitted by means of aphids from diseased to healthy plants. The disease was observed last year in New Jersey for the first time (R. F. Poole). It was also reported from Indiana and Minnesota. The disease has not yet attained any marked economic importance. Reference: Poole, R. F. Celery mosaic. Phytopath. 12: 151-154. Mar. 1922.

Plants covered with a slime mold, Physarum gyrosum, were collected in Orange County, New York. The determinations were made by Dr. Frank Wann.

Root knot caused by Heterodera radicicola (Greef) Müll. was noted in shaded and wet areas in greenhouse beds and in low, wet fields in New Jersey. Infection was more pronounced on Golden Self-blanching than on the green varieties. (Poole) In Florida nematodes were unusually prevalent on celery. (See root knot on lettuce - note by Foster)

Bunched red roots (physiological ?) was once called to the attention of G. P. Clinton in Connecticut.

Frost injury is reported by C. L. Brown (Bur. Mark. & Crop. Est. Div. Letter 7: 31. Feb. 2, 1922), from California as follows:

> "Shippers tell me that northern celery (Sacramento Section) is severely injured, and not very many future shipments will come from there. Damage around here (Los Angeles) is estimated by some at 50%, but that is only guess work. All we know for sure is that there has been considerable damage."

General reference

Whetzel, H. H. Celery diseases. Agr. Bul. Bermuda Dept. Agr. 2: 7-8. 1923.

CHICORY

Root knot caused by nematodes was reported from Barnstable County, Massachusetts. It was the only authentic report of nematodes on outdoor crops in this state. (Osmun)

EGG PLANT

Leaf spot and fruit rot caused by Phomopsis vexans (Sacc. & Syd.) Harter was recorded as follows: New York (reported only once, but common in

Schenectady, Monroe and Erie Counties); New Jersey (generally distributed, some well sprayed fields almost free from rot; one unsprayed field had approximately 80% diseased fruit); Maryland (5% loss, same as usual); Florida (quite prevalent and doing much damage); Ohio (one report); Illinois (2% loss, less serious than last year); Wisconsin (trace - crop of minor importance); and Iowa (trace).

According to Edgerton, and Moreland (Louisiana Agr. Exp. Sta. Bul. 178. 44 p., 1921), "The egg plant blight (Phomopsis vexans) reduces the yield in Louisiana 50-75%.....Spraying is successful only when the plants are kept covered with the fungicide, which requires 10 to 12 sprayings in Louisiana. Control measures advocated include clean seed, rotation, strong plants for transplanting to the field, and the use of the most resistant varieties."

Wilt caused by Verticillium albo-atrumReink. & Berth. was present in New York (especially Schenectady County), Indiana (serious in market gardens), Pennsylvania, and New Jersey (more than usual, in all sections but more prevalent in southern part of state).

Leaf spot caused by Macrosporium solani E. & M. was reported by Clinton from Connecticut.

Phytophthora terrestris Sherb. caused rot of immature fruit and premature dropping of fruit in the experimental gardens in Indiana. Kendrick (See Proc. Ind. Acad. Sci. 1922) shows that the organism is the same as that causing buckeye rot of tomato.

Mosaic - Connecticut. (G. P. Clinton)

An undetermined disease caused almost a complete failure of egg plants in Kentucky. Spraying with Bordeaux mixture helped. (J. S. Gardner)

Damping-off caused by Rhizoctonia sp. was observed in Florida. No great loss was sustained.

General references

Ishikawa, Takitaro & Isamu Shiozaki. Sekkwai iwo gozai dojo shodoku to nasu (Soil disinfection with lime sulphur and its effect on the egg-plant). Byochuggai Zasshi (Jour. Plant Prot.) 9: 29-34. January 1922.

Welles, C. G. and E. F. Roldan. Solanaceous wilt in the Philippine Islands. Philipp. Agr. 10: 393-398. Mar. 1922.

__________ Cercospora leaf spot of eggplant. Phytopath. 12: 61-65. Feb. 1922.

ENDIVE

Watery soft rot caused by Sclerotinia libertiana Fckl. resulted in heavy losses (15-20%) in trucking districts around New Orleans, Louisiana. The decay began on the lower leaves, and finally involved the whole plant.

Heart rot (cause undetermined) caused a rot of tender soft leaves of endive in New Jersey. The loss was slight.

ESCAROLE

Watery soft rot caused by Sclerotinia libertiana Fckl. injured 35 to 50% of the crop in Louisiana, and caused a loss of 2 to 5%.

Mosaic caused slight loss in Louisiana.

GINSENG

Corroded roots from which Ramularia was isolated repeatedly were reported from Washington by Dana.

LETTUCE

Drop caused by Sclerotinia libertiana Fckl.

Drop is a very serious disease of lettuce particularly under glass. It may also cause much loss on muck farms, although in the latter case the Rhizoctonia bottom rot is often mistaken for it. It is probably present in all the commercial lettuce areas. In 1922 it was more or less serious in Massachusetts (most serious disease of lettuce), New York (1-2% loss, confined mostly to greenhouses), New Jersey (0.75% loss on muck farms), Delaware (important locally), Pennsylvania (5-30% in sash and field in Philadelphia district), South Carolina (trace), Florida (important in storage), Louisiana (5% loss), Ohio (a greenhouse trouble), Indiana (serious in greenhouses), Minnesota (2.7% loss), Kansas (Considerable in greenhouses), and Washington. Higher temperatures evidently tend to reduce the amoung of drop. Dr. I. C. Jagger made the following comments in a letter (Jan. 10, 1922):

> "The early fall lettuce, which is harvested before December 1, is invariably little injured by Sclerotinia, but after December 1, Sclerotinia becomes increasingly destructive, and is always a serious trouble on lettuce harvested during the last half of December and during January and February."

References

Beach, W. S. The lettuce drop due to Sclerotinia minor. Pennsylvania Agr. Exp. Sta. Bul. 165. 1921.

Botany and Plant Pathology. Pennsylvania Agr. Exp. Sta. Bul. 170: 15-20. 1922. Continued observation of S. libertiana show that the fungus will die in the soil in two years if no susceptible crop is grown.

Soursac, Louis. La pourriture du collet de la laitue et de la chicorée. Rev. Bot. Appl. 2: 562-567. Oct. 1922.

Bottom rot caused by Rhizoctonia solani Kühn

Bottom rot was reported from Massachusetts, New York, Pennsylvania, and Kansas. In New York this is by far the most serious field disease, the average loss being estimated at 10 to 15%. Occasionally the entire crop of a field is wiped out. In Massachusetts the disease seemed to be most important under glass. In Pennsylvania there was a 40% loss of Big Boston in the Philadelphia section. In the greenhouses of Ohio a root infection occurred, resulting in rosetted plants. In New York breeding for disease-escaping strains is still continued.

Tipburn (non-parasitic)

Tipburn was the second most serious disease of field lettuce in New York State. The loss was estimated by A. G. Newhall as being 5 to 10%. It was worse on Big Boston than on Romaine. There was about 3% loss on the Los Angeles Market variety. It was also reported from Colorado, South Carolina, Texas and Idaho, but was not deemed of economic importance in these states, except in Texas where Taubenhaus is making a study of the disease.

Bacterial diseases of lettuce

Bacterial rosette caused by Aplanobacter rhizoctonia Thomas was found in Ohio chiefly in greenhouses although discovered on head lettuce grown in the field and causing 5 to 10% loss. Lettuce rot caused by Bacterium viridilividum Brown (?) and dwarfing caused by Bacterium vitians Brown (?) were both observed in New York. Bacterium marginale Brown was reported from Kansas. A bacterial leaf spot (cause undetermined) was observed on lettuce in Florida. In Oregon an internal leaf rot (bacterial (?)) caused 2% loss at Multnomah. It was general in Klamath and present in the Malheur irrigated districts. In Mississippi a bacterial (?) spot possibly following excessive use of nitrogenous fertilizer and in Arizona, following frost injury were mentioned. In the latter state one field of 110 acres, in addition to several smaller ones, was practically a total loss.

Reference

Thomas, R. C. A bacterial rosette disease of lettuce. Ohio Agr. Exp. Sta. Bul. 359: 197-214. 1922.

Gray mold rot caused by Botrytis cinerea Pers.

Gray mold rot was unusually prevalent in St. Louis County, Minnesota, causing 10% reduction in yield. In New Jersey during the rainy weather it also caused a great depreciation in marketable value of the crop by rotting the top and bottom leaves of field grown lettuce. In Massachusetts, New York, Ohio, Iowa and Kansas, it did considerable damage under greenhouse conditions.

Downy mildew caused by Bremia lactucae Regel.

Downy mildew is usually of economic importance only in poorly ventilated greenhouses and hot beds, although occasionally it may become serious under field conditions. In 1922 it was reported from Massachusetts, New York, New Jersey, South Carolina, Ohio, Indiana, Minnesota, Iowa, Colorado and California. In nearly all cases it was a minor disease. In New York, New Jersey and Minnesota where it occurred in the field the date of earliest appearance was late June and July, when the temperature was below normal. In New York the second crop which is harvested in the fall ordinarily is attacked. This year it was the first crop that was affected. Incidentally July temperature was subnormal (-0.5°F.) and September temperature above normal (+1.9°F.). In addition, the percentage of fair weather in July was between 40 and 50%, while in September it was between 50 and 60% (See Monthly Weather Review 50, Nos. 7 and 8. 1922). Of course, this information alone is too meagre from which to draw conclusions, but it coincides with the data obtained by A. T. Erwin (Controlling downy mildew of lettuce. Iowa Agr. Exp. Sta. Bul. 196: 1921) who found that downy mildew was most severe when the percentage of sunshine was below 55, and the temperature below 55°F.

Following are reports from collaborators concerning downy mildew:

Massachusetts: Not ordinarily serious. Usually associated with faulty ventilation. (Osmun)

New York: Slightly more on first crop. Usually there is more on the second crop. A few growers tried the variety Los Angeles Market, but it mildewed badly. (Newhall)

South Carolina: Crop could not have been shipped but large part of loss was obviated by selling locally. (Ludwig)

California: Very general in all fields in state. Loss on 8000 acres about 4%. (Milbrath)

Other diseases

Rio Grande disease (cause unknown) caused .5% loss in Texas according to Taubenhaus, who says:

> "This disease attacks the lettuce in which it frequently causes serious damage. The disease was found on two new hosts, the carrot and a weed known as Borage, a plant which the Mexicans use for food for burros."

Leaf spot caused by Alternaria sp. is reported by A. C. Foster from Florida as follows:

> "In several instances I have found typical Alternaria leaf spots on lettuce, the characteristic concentric rings and spores being present. I do not know whether this has been reported on lettuce before."

Root knot caused by Heterodera radicicola (Greef) Müll. was found mainly in hot houses in Ohio. It was controlled by steam sterilization. Foster of Sanford, Florida, gave the following information:

> "The infestation of nematodes rather generally throughout the section on all of the different crops has probably caused as much concern as any one disease. Both lettuce and celery seedlings were heavily affected in the seed beds, to such an extent that in some cases the grower sustained a total loss of his plants. The disease is now very common in the field, especially on celery, and will no doubt cause heavy losses. As a rule the growers in this section do not take any precautionary measures to prevent losses from nematodes either in the seed beds or in the field, but there are a few instances where a more progressive grower has tried the formaldehyde treatment of his seed bed or the cyanamide treatment of sections of his field. Results obtained so far have not been encouraging."

Anthracnose caused by Marssonia panattoniana (Berlese) Magnus was rarely found in New York, Florida and Washington.

Mosaic, according to A. G. Newhall, is the third most serious disease of lettuce in New York. The virus is carried by potato aphids and in the seed. One to three percent of the young seedlings are affected. The loss in 1922 was 2-3%. In the average year the loss has been 5-6%. It was also reported from Florida (fairly important), Minnesota (first report), and Connecticut (two reports on Cos lettuce).

Dwarfing caused by Pythium sp. is present, both in the field and under glass in New York State. The loss is merely a trace.

Damping-off in Florida is reported by Foster as follows:

> "Many of the growers have experienced rather heavy losses of seedlings because of damping off, that is probably caused by several different organisms, possibly Pythium, Phytophthora, and in a few instances possibly Sclerotinia."

Southern blight caused by Sclerotium rolfsii Sacc. was of little importance in Florida, according to Foster.

Leaf spot caused by Septoria consimilis E. & M. or Septoria lactucae Pass. was reported from New York (Present first time in several years. In few fields severe; affects only outer leaves. One man had entire loss of crop. Loss for state, t-2%), New Jersey (Slight. This disease was quite severe in one field of lettuce. The loss amounted to about 50%. The plants rotted or were worthless after becoming diseased.), Indiana (Serious locally), Illinois (trace), Minnesota (First report in the State), and Missouri (One report).

White heart or rabbit ear was rare in New York State this season. A. G. Newhall is of the opinion that the disease is either produced by aphids, or the causal agent is disseminated by them.

Foot rot (formerly called heart rot; cause unknown) was serious in the Imperial Valley, California. The loss was 5% in 8000 acres. (Milbrath)

A stunting in young stages of the early crop was noticed in Kentucky. No cause was assigned.

Frost injury was very important in the Los Angeles section of California, according to C. L. Brown, Bur. Mark. & Crop Est. Fruit & Veg. Div. Letter 3: 45. Feb. 16, 1922, who says:

> (Feb. 6) "The frosts have cleaned up the lettuce in the Los Angeles section to the extent that there is scarcely enough lettuce for the local market, and this is of very poor quality. Imperial Valley lettuce was undoubtedly injured to quite an extent."

Stunting resulting from an excess of soluble salts in the surface soil (reason given by S. D. Conners, who has made a study of this type of trouble) occurred in patches in many greenhouses. The trouble was controlled by leaching and better under-drainage. (M. W. Gardner)

MANGEL

Damping off caused by Sclerotinia libertiana Fckl. developed rather abnormally in one field on Long Island.

Rhizoctonia sp. was observed in Washington by Dana. He also reported a leaf blight, the cause of which was not determined.

OKRA

Wilt caused by Fusarium vasinfectum Atk. was observed in Louisiana and Texas. The injury was slight in each case.

Wilt caused by Verticillium albo-atrum Reink. & Berth. was found in Burlington County, New Jersey.

Texas root rot caused by Ozonium omnivorum Shear reduced the yield in Texas 10%, according to Taubenhaus.

Root knot caused by Heterodera radicicola (Greef) Müll. was serious in some limited sections of Louisiana, according to Edgerton, and caused 1% loss in Texas. (Taubenhaus)

PARSLEY

Bacterial wilt caused by Bacillus nelliae Welles is reported from the Philippines. Reference: Welles, C. G. Identification of bacteria pathogenic to plants previously reported from the Philippine Islands. Philipp. Jour. Sci. 20: 279-285. Mar. 1922.

Leaf spot attributed to Cercospora apii Fr. or Cercosporella pastinaceae Karst. was reported from New York (serious), Connecticut (bad in one place), West Virginia (abundant in one garden), Indiana (serious locally), and Minnesota (a trace). There seems to be a want of agreement among the collaborators as to the exact fungus causing the injury. This point should be cleared during the coming summer.

Blight caused by Mycosphaerella pinodes Berk. & Blox.

Ascochyta blight was found in New York, Delaware, South Carolina, Wisconsin and California. Milbrath reported that the disease was very severe in Carlsbad, Pismo, Hayward and Ignacio regions, California. There was 15% loss on 4,000 acres. Reports in the Plant Disease Survey files indicate that the disease has been found previously in 26 states. No doubt it occurs elsewhere, and collaborators from the states which are not marked on the accompanying map should report if it has been collected, so that the distribution could be given more accurately.

Powdery mildew caused by Erysiphe polygoni DC.

Powdery mildew coming late on an early harvested crop is usually not an important disease, but there are certain exceptions as are indicated by the following comments:

Florida: Mildew was reported from one section of the state and was said to be the cause of many failures in pea growing. (Burger)

Mississippi: Reported from several localities throughout the state causing rapid defoliation of vines and reduced yield. Common in many gardens in this vicinity and in Starkville. (Neal)

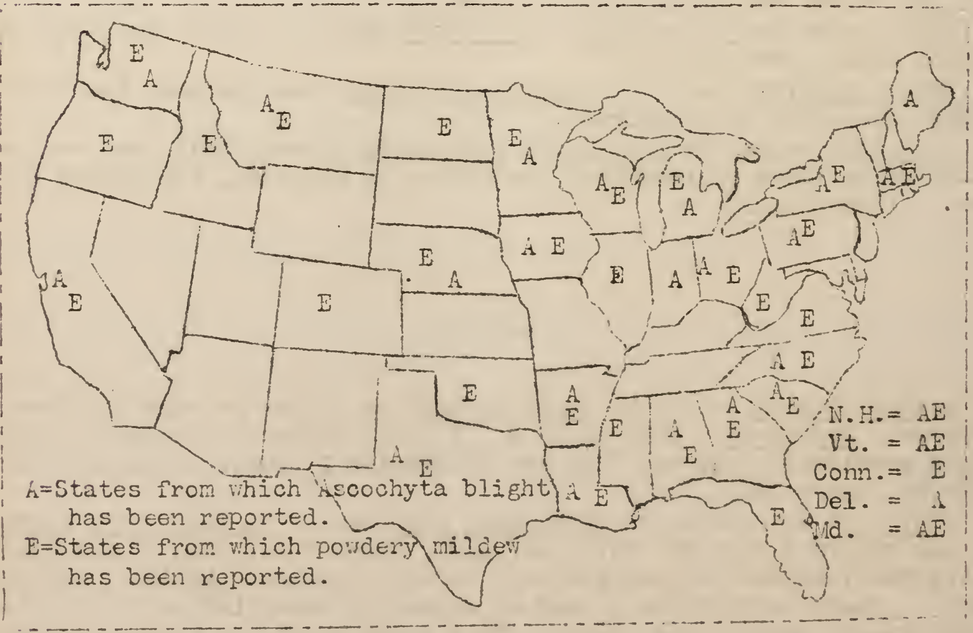

A=States from which Ascochyta blight has been reported.
E=States from which powdery mildew has been reported.
N.H. = AE
Vt. = AE
Conn. = E
Del. = A
Md. = AE

Fig. 13. Distribution of Ascochyta blight and powdery mildew of peas. Data obtained from all Plant Disease Survey reports, including those of 1922. (Collaborators should check this list of states and make any additional reports they may have.)

Illinois: Destructive especially on late maturing varieties. (Gardner)

Oregon: Two or three reports from Clatsop County where the whole section around Brownsmead is reported by the county agent to be affected especially in places protected from the wind. (Barss)

California: Reported on canning crop but not starting early enough to be destructive on winter crop in central California this year. (Horne)

In addition, the disease was reported from Ohio, Wisconsin, and Colorado. In the past it has been reported from 34 states, but like Ascochyta blight, is probably present wherever peas are grown.

Root rot caused by *Fusarium* sp.

Fusarium root rot was mentioned only in Massachusetts (more serious than usual); New York (2-3% loss); Delaware (important locally); Ohio (serious); and Indiana (50% loss on one farm). But judging from previous records it is much more widespread. Different species of Fusarium have been named in connection with the root rot, but no detailed studies have been made. It would be very desirable to have more accurate knowledge regarding the different species which may cause pea root rot, and the distribution of each of these species.

Varietal susceptibility

According to Temple, very promising results have been obtained in their work on root rot resistance in Maryland. The following quotation is taken from a letter from Prof. Temple, June 12, 1922:

> "Our pea work with respect to resistance to the root rot has given better results this year than heretofore. The commercial stock produced a full crop on the worst infected soil that we could find. These results were very conspicuous this year, and very promising."

Other fungi which were associated with pea root rot were *Thielavia basicola* (B. & Br.) Zopf. (Connecticut), *Pythium debaryanum* Hesse (?), Connecticut, Delaware, Wisconsin, Montana), *Rhizoctonia* sp. (Delaware, Wisconsin), and undetermined root rots were reported from New Jersey, Maryland, Wisconsin, and Minnesota.

Delaware: *Rhizoctonia* sp., *Pythium* sp., *Fusarium* sp. Yield reduced 20%. Drouth and aphis attack appeared to retard growth and favor severe prevalence of the root rot. (Adams)

New Jersey: Root rot, undetermined. Yield reduced 20% for the state. Severe in southern counties. Several reports from Sussex County northern portion. (C. M. Haenseler)

Wisconsin: Pythium, Rhizoctonia. State yield reduced 5%. Especially severe where peas grown without rotation. Prof. Delwiche reports pedigree "Horal" strains highly resistant compared with Hosford. (Vaughan)

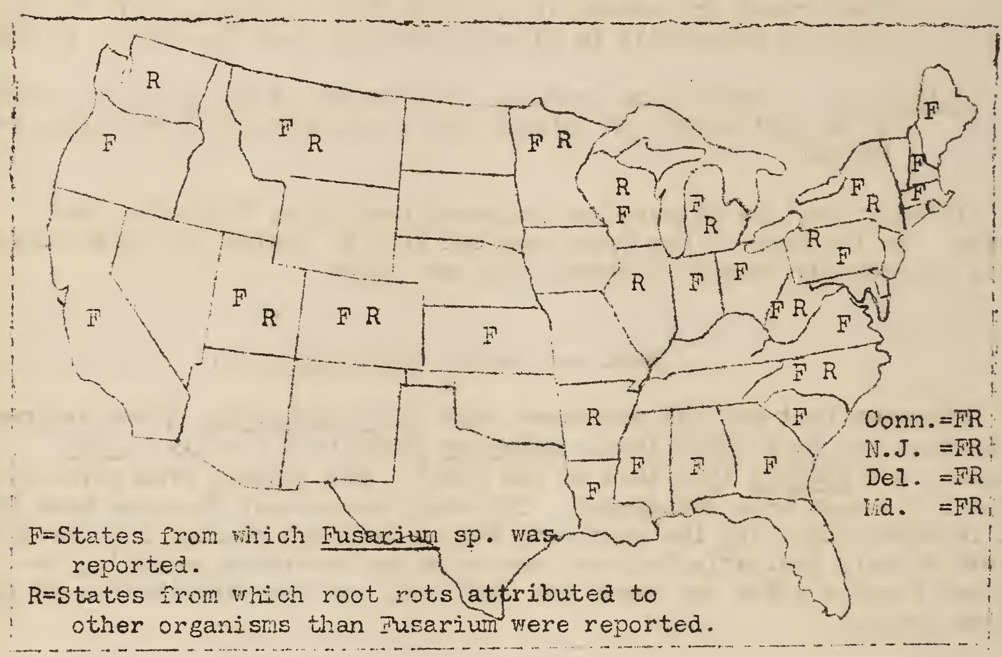

R
F
F R
F R
F
F
F
F R
F
R F
F R
R
F
R
F
F
F
F R
F
F R
F R
F
F
R
F
F
F
F
F
Conn.=FR
N.J. =FR
Del. =FR
Md. =FR
F=States from which Fusarium sp. was reported.
R=States from which root rots attributed to other organisms than Fusarium were reported.

Fig. 14. Distribution of pea root rots. Data obtained from all plant disease survey reports including those of 1922. (Collaborators should check this list of states and make any additional reports they may have.)

(Root rot, several fungi) Causing considerable damage on old pea land. Some canneries estimating loss at 40%. Long rotation is vitally important to keep away from root rot. (Vaughan)

Montana: Root rot common in fields planted to peas for first time as well as in soils cropped to peas for second and third year. Number of affected plants in old fields greater than in new fields. (Jennison)

Other diseases

Bacterial blight caused by Pseudomonas pisi Sackett (?) was observed in South Carolina, Wisconsin and Montana. It was not of great importance, however. In Wisconsin a few fields were badly blighted. There was considerable on green and Scotch field peas, and on Admiral and Multiplier canning variety. There was a slight amount on Golden vine. (Vaughan)

Leaf spot caused by Septoria pisi West. was found in Minnesota and Wisconsin. It has previously been reported from the following additional states: Maine, New York, Pennsylvania, Delaware, Maryland, Ohio, Texas, Indiana, Michigan, Colorado, Montana, and California. Only Texas and

California among these may be called warm climate states. It would, therefore, be of interest to know whether the disease occurs in other Southern States or if the Septoria thrives best at the lower temperatures of the North.

Anthracnose caused by Colletotrichum pisi Pat. Fred Reuel Jones and R. E. Vaughan, in their recent article on "Anthracnose of the garden pea" (Phytopath. 11: 500-503. Dec. 1921) give the following information:

> "Anthracnose of the garden pea caused by Colletotrichum pisi Pat. has been found causing great damage to peas grown for canning purposes in two localities in Wisconsin in 1912 and 1920. At present the disease appears to be of limited distribution in America. The fungus infected readily all species of the genus Pisum that were tried, but no host outside of this genus was found."

Rust caused by Uromyces pisi (Pers.) Winter. Miss Louise Dosdall, of University Farm, Minnesota, writes regarding this disease:

> "We have found a light infection of rust on peas, Alaska Wonder. This is the first time we have found a rust on this crop in this state. As yet we have not identified the organism, but it is probably Uromyces fabae."

An Uromyces had previously been reported from Nebraska and North Dakota.

Reference

Buchheim, Alexander. Zur biologie von Uromyces pisi (Pers.) Winter Centralbl. Bakt. abt. 2, 55: 507-508. Feb. 1922.

Traces of downy mildew caused by Peronospora viciae Berk. was found in Wisconsin and in Sacramento County, California.

Damping-off caused by Fusarium sp. was reported from Florida. Cultures were made of the fungus by O. F. Burger.

Rough pod spot (non-parasitic) was mentioned as present by Dana of Washington.

Frost injury - Early plantings of peas were badly injured by frost in the Imperial Valley, California, according to C. L. Brown.

An undetermined disease was reported by D. B. Milbrath from the Carlsbad region, California, where it caused 80% loss on 900 acres.

PEANUT

Leaf spot caused by Cercospora personata (B. & C.) E. was generally present in Virginia, South Carolina and Florida. A slight amount of the disease was also seen in Arkansas.

Bacterial wilt caused by Bacterium solanacearum EFS was observed in Florida in a ten-acre field, the crop of which it nearly destroyed.

Southern blight caused by Sclerotium rolfsii Sacc. was reported from South Carolina where it manifested itself in stem, root and nut rot.

Texas root rot caused by Ozonium omnivorum Shear resulted in 8% loss in Texas. (Taubenhaus)

Chlorosis which Taubenhaus attributed to an excess of lime in the soil, was reported from Texas.

PEPPER

Leaf spot caused by Cercospora sp. was rather common in Louisiana. It apparently was more severe on the Piementos. (Edgerton)

Mosaic was said to be of minor importance in Connecticut, Louisiana, Indiana and Minnesota.

Fruit rot caused by Alternaria sp. was reported by Anderson and Tehon of Illinois.

Bacterial spot caused by Bacterium vesicatorium Doidge was serious in a few market gardens in Indiana. M. W. Gardner writes, "Kendrick and I have compared the pepper organism isolated by I. C. Jagger in Florida, with our Bacterium exitiosum and a culture of Bacterium vesicatorium obtained from Miss Doidge, and find them practically identical, so the correct name is Bacterium vesicatorium Doidge."

Wilt caused by Bacterium solanacearum EFS did considerable damage in home gardens about Roanoke, Virginia, and a trace was found in Texas.

General references

Higgins, B. B. The bacterial spot of pepper. Phytopath. 12: 501-516. November 1922.

____________ Seed treatment in the control of pepper diseases. (Abstract) Phytopath. 13: 57-58. Jan. 1923.

Leonian, L. H. Stem and fruit blight of peppers caused by Phytophthora capsici sp. nov. Phytopath. 12: 401-408. Sept. 1922.

RHUBARB

Leaf spot caused by Ascochyta rhei E. & E. was found in market gardens about Indianapolis, Indiana. (M. W. Gardner)

Leaf spots caused by Cercospora sp. (Illinois) and Phyllosticta straminella Bres. (Illinois and Minnesota) were reported.

Milbrath reports an undetermined disease as follows:

> "Lesions on stem and ribs 1-3 mm. All varieties of rhubarb affected in Southern California. 500 acres. Loss caused in transit through secondary organisms. Loss 12%."

Crown and stalk rot caused by Phytophthora parasitica var. rhei Godfrey and Phytophthora cactorum (Leb. & Cohn) Schröt. is by far the most serious trouble of rhubarb. The former species was found in Kansas, Maryland, and Virginia. *P. cactorum* was found by Beach in eight fields in the Philadelphia section of Pennsylvania. One of the species (not determined) was an important rhubarb parasite in Illinois, especially in Union County (Tehon and Anderson).

References

Beach, W. S. The crown rot of rhubarb caused by Phytophthora cactorum. Pennsylvania Agr. Exp. Sta. Bul. 174: 1-28. July 1922.

Godfrey, G. H. A Phytophthora foot rot of rhubarb. Jour. Agr. Res. 23: 1-26. Jan. 6, 1923.

SALSIFY

White rust caused by *Albugo tragopogonis* (DC.) Gray was common in Vermont and New York.

Reference

Ritzema Bos, J. Bestrijding van de zoogenaamde "witte roest" der schorzeneeren, veroorzaakt door *Cystopus tragopogonis* (Persoon) Schroet. (Combating the so-called "white rust" of salsify caused by *Cystopus tragopogonis.*) Tijdschr. Plantenz. 26: 216-220. 1920. (Abstract in Bot. Absts. 10: Entry 1900. Feb. 1922)

SPINACH

Downy mildew caused by *Peronospora effusa* (Grev.) Rab. was reported from Texas (10% loss), Minnesota (trace), Washington, and California. The two following reports from California are interesting:

> "Infection in all regions where crop was grown. Disease severer than usual on account of low temperature and moisture. Loss 3 percent. Acreage 5,000. (My estimate.)" (D. G. Milbrath)
>
> "All spinach fields in the Imperial Valley inspected so far show infestations of downy mildew, but the damage is negligible in every case except where the stands of spinach are over thick, or where weeds or grasses have been allowed to grow abundantly, or where the spinach has been over-irrigated. In some fields the loss of marketable spinach will run from 5-15%." (W. S. Childs)

Rust caused by *Puccinia subnitens* Dietel. Dana, of Washington, reports, "Several carloads loss to Walla Walla growers." Barss, in Oregon, gives the following information (Phytopath. 12: 446. Sept. 1922):

> "On May 4, 1922, liberal samples of spinach leaves were forwarded to the Oregon Experiment Station by J. B. Wiley from the Walla Walla Valley. These leaves were abundantly sprinkled with the bright orange cluster cups of a rust.

> The vegetable growers of the Walla Walla Valley have sustained heavy losses on the spinach, both in the early and late crop. No losses from such a disease have been reported to the Oregon Experiment Station in previous years, and the growers in the district report no commercial losses from this cause in previous years. Inasmuch as there appears to be no common rust disease accompanying spinach production in most parts of the world it was at once expected that some native rust had attacked the spinach. Puccinia subnitens Dietel was suspected and a search for the salt grass or alkali grass Distichlis spicata which is the telial host of this rust proved that the alkali grass was one of the three most common grasses growing in the vicinity of the spinach beds.
>
> "Specimens of this grass collected by Mr. Wiley close to the spinach beds were completely covered with the telial sori of Puccinia subnitens. Cultural experiments at Corvallis under experimental control have demonstrated the ability of the rust sporidia from this material to produce aecial infections on the cultivated spinach."

Leaf spot caused by Cercospora flagelliformis E. & H. was observed in Indiana and Minnesota. The Minnesota report reads:

> "On a one-tenth acre plot at University Farm in which plants were grown for seed, the leaves were very heavily spotted, especially the lower ones. This is the first report we have of this disease in Minnesota. (Sect. Plant Path.)

Anthracnose caused by Colletotrichum spinaciae E. & H. - Texas, trace. (Taubenhaus)

Blight caused by Fusarium sp. is reported from Idaho by Hungerford (Phytopath. 12: 447. Sept. 1922), who says:

> "A rather serious disease has recently been found in several localities in Idaho. The disease appears when the plants are quite small, causing a stunting of the plants, curling of the leaves and finally the death of the plants. A species of Fusarium has been constantly isolated from the interior of the crowns and roots of the diseased plants. The characteristic symptoms of the disease have been produced upon plants grown in sterilized soil to which had been added a pure culture of the organism.
>
> "Dr. C. D. Sherbakoff, to whom a culture was sent for identification, has found that the Fusarium belongs to the Martiella-Elegans section and is sufficiently different from all previously described Fusaria to be considered a new species."

Damping-off caused by Pythium debaryanum Hesse - Connecticut - one report. (Clinton)

Mosaic did considerable injury in New Jersey, Virginia, and Indiana. In Virginia a resistant variety developed at the Truck Station will soon supplant the commercial sorts. (Fromme) It was reported by H. D. Brown to be very serious near Evansville and New Albany, Indiana. (Gardner) In New Jersey there is a striking resemblance of the diseased plants to those affected by lack of nutrition. Mosaic appears in patches in the field rather than being distributed uniformly.

Crown rot (cause undetermined) caused 5% loss in some fields in New Jersey. It was a rot of the central shoots and crown, and was most common during the rainy weather.

Frost injured spinach around both Los Angeles and in the Imperial Valley of California. (C. L. Brown)

SWISS CHARD

Leaf spot caused by *Cercospora beticola* Sacc. was reported from Louisiana, Texas, and Colorado. It did only slight damage in Louisiana and Colorado. From Texas, Taubenhaus writes:

> "A serious leaf-spot frequently ruins the leaves of this plant making it unfit for market. The cause of this spot is *Cercospora beticola*, the same fungus which attacks the beets and as proved by cross inoculation."

A *bacterial disease* resembling that caused by *Bacterium aptatum* Brown & Jamieson is reported from Texas as follows:

> "Swiss chard affected with leaf spot, *Cercospora beticola*, was also found to be affected by a new disease hitherto undescribed. Cultures of the diseased material yielded a bacterial organism closely resembling *Pseudomonas aptatum*, which is parasitic on the beet and the nasturtium." (Taubenhaus)

Root knot caused by *Heterodera radicicola* (Greef) Müll. was commonly present in some soils in Louisiana.

Southern blight caused by *Sclerotium rolfsii* Sacc. - South Carolina - unimportant. (Ludwig)

Curly top (cause undetermined). "Stecklings planted for seed production severely affected. In some regions whole crop loss." (Milbrath - California)

Miss Florence Hedges,
Laboratory of Plant Pathology,
U. S. Department of Agriculture,
Washington, D. C.